

**USEPA PROJECT XL FINAL PROJECT
AGREEMENT**

BIOREACTOR PILOT PROJECT

**Anne Arundel County Department of Public
Works**

**Waste Management Services
Millersville Landfill and Resource
Recovery Facility**

**Severn, Maryland
December, 2000**

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I. Introduction to the Agreement

A. Description of the Project and Its Purpose

This document contains the details of the Final Project Agreement (FPA, or Agreement) between Anne Arundel County (County), the United States Environmental Protection Agency ("EPA"), and the Maryland Department of the Environment (MDE)) (collectively, the "Parties") documenting the Parties plans to allow the County to implement certain bioreactor operations (involving the additions and/or Recirculation of bulk liquids, including landfill leachate), at the County s Millersville Landfill and Resource Recovery Facility (Facility) located in Severn, Maryland. The general location of the facility is shown on Figure 1. This FPA summarizes the Parties plans for the project, and its expected benefits.

In the past, the design goal of a traditional landfill was to minimize the quantity of water introduced into the landfill, thus minimizing leachate generation. One consequence of this approach is that biodegradation occurs very slowly, thus leaving waste in a relatively undecomposed state for a long period. As a result, the liner system remains exposed to leachate for a longer period of time, and undecomposed waste continues to be a potential source of groundwater contamination throughout the post-closure period.

Bioreactor landfills are an emerging approach which are expected to achieve more efficient and effective solid waste management. Bioreactor techniques are expected to deliver superior environmental and economic benefits to the community. Bioreactor techniques deliver environmental benefits by reducing the amount of leachate that is discharged to publicly owned treatment works; postponing or avoiding new landfill construction; and reducing the need for long-term maintenance during the post-closure care period. These same attributes also deliver economic benefits: reduction of leachate treatment costs; the postponement or avoidance of the costs of new landfill construction; and the reduction in post-closure operations and maintenance costs.

As part of the project the County is requesting that EPA grant it regulatory relief from certain requirements of the Resource Conservation and Recovery Act, 42 U.S.C. § 6901 et seq. ("RCRA") that restrict application of bulk liquids in municipal solid waste landfills constructed with particular liner designs, as set forth in Title 40 of the Code of Federal Regulations (40 C.F.R. § 258.28).

The landfill cells at the Facility were constructed with a geomembrane composite double-liner system, with primary leachate collection and leak detection (secondary collection) layers. Details of the liner and leachate collection system are set forth in Attachments V and VI of this FPA. This composite double liner system provides a high level of protection to the environment against potential impacts caused by leakage of leachate. While the liner design does not meet the specified liner **design** requirements under RCRA (40 C.F.R. § 258.40(a)(2) and (b)), which a landfill presently is required to have in place for bulk liquids to be added (40 C.F.R. § 258.28(a)(2)); the Facility s liner system does meet or exceed the **performance** requirements for municipal solid waste landfills and EPA and MDE has determined that it is equivalent or superior to the specified liner requirements. For this reason, the project sponsors believe that this

landfill is an excellent candidate for the bioreactor techniques that would be tested under this FPA.

The County's pilot project will involve injecting certain bulk liquids (leachate and/or storm water) through buried injection devices into a 3/4 acre portion of the Facility's Subcell 8-4 for a period of up to seven years (depending on effectiveness), and monitoring the settlement that results as well as other effects. If the pilot project is successful, the County would like to expand the use of bioreactor techniques to other areas on Cell 8 (and future Cell 9) at the Facility. (The Parties recognize that such expansion would require further regulatory change outside the scope of this XL Project.)

The County has developed a detailed stakeholder participation plan that will promote full involvement of federal, state and local groups in the pilot project. The County plans to monitor the project's success and will publish updates on its website and in a local newsletter. The County has also committed the staff and budget to ensure that this pilot project can move forward, should it receive regulatory flexibility through the Project XL Program. The County believes that this project, if successful, will be transferable to other landfills in the Mid-Atlantic United States with similar wastes and climates.

B. Description of the Facility and Facility Operations/Community/Geographic Area

The Facility is located on a 565-acre portion of land in Severn, Maryland, approximately 15 miles south of Baltimore. The Facility is owned and operated by the County and is the only active municipal solid waste (MSW) landfill in the County. The Facility accepts approximately 390 tons per day (tpd) of MSW (FY00), of which 1/3 (approximately 130 tpd) is recovered for reuse and recycling and the remaining amount (approximately 260 tpd) is land filled at the Facility. The Facility serves on average 660 customers (residents and businesses combined) per day, 7 days per week.

The Facility currently consists of six cells (refer to Attachment I). Cell 1-East, Cell 2, Cell 4, and Cell 5-6-7 are separate mounds that are filled, closed, and capped. Cells 3 and 1-West were excavated and relocated into lined Cell 8 in 1994 and 1996, respectively. Cell 8 is currently accepting waste, and Cell 9 is scheduled to be constructed in the future, when Cell 8 is filled to design grades. Cell 8 has eight subcells. Subcells 8-1 through 8-6 have been constructed and are all partially or nearly filled. The next subcell planned for construction is Cell 8-8, occurring in 2006. Cell 8 is designed to ultimately receive 5.6 million cubic yards (MMcy) of waste and Cell 9 for 8.7 MMcy. The final elevation of Cell 8 will be 243 feet above mean sea level (MSL). The waste composition in Cell 8 in the area of the proposed XL Project is described in more detail in Section II.B. of this FPA (Detailed Description of Project, Test Area Location).

The Facility was constructed with a geomembrane composite double-liner system, with primary leachate collection and leak detection (secondary collection) layers. Details of the liner and leachate collection system are set forth in Attachments V and VI of this FPA. The base of Cell 8 is underlain by at least 5 feet of unsaturated clay and sand. The Cell 8 liner and leachate

collection system (double-liner system) has been approved by EPA and MDE. (See Attachment II.)

The Facility presently generates approximately 8,000 gallons of leachate per day. Leachate from Cell 8 is collected from subcell sumps (one sump per subcell) and piped to a wetwell, from which it is pumped to a 305,000 gallon influent tank. The leachate then flows to a pretreatment plant at the Facility in which it is treated in controlled batches. From there it is discharged into a 305,000 gallon effluent tank and ultimately discharged to the sanitary sewer via a force main on site, from which it is conveyed via force main to a publicly operated wastewater treatment works.

Forty-three groundwater and 29 LFG monitoring wells are installed at the perimeter of the Facility. The groundwater monitoring wells are installed within each water-bearing zone in the subsurface beneath the Facility. The groundwater wells are sampled semiannually, and the LFG monitoring wells are monitored quarterly.

There are approximately 5,800 residents within a 1-mile radius of the Facility; approximately 2,750 within a 0.5-mile radius; and approximately 900 within a 0.25-mile radius (refer to Attachment III). The County has developed a stakeholder participation plan (see Section III.C. below) to engage these nearby residents in the proposed project.

This XL Project is part of the County's larger efforts to further improve the management of its solid waste. During 1995 the County adopted a comprehensive Solid Waste Management Strategy, the main objective of which is to extend the life of the Facility as long as possible. The plan comprises an integrated system involving waste reduction, recycling, reuse and innovative technologies that provides for a multi-faceted approach for meeting the County's future solid waste management needs. When the Facility opened in 1975 the facility had a projected life of 25 years, or until the year 2000. When the 1994 Solid Waste Management Plan was adopted the projected completion of Cell 8 was in 1997, and the entire facility was expected to be active until 2008. As of December 1995 the expected projected closure date for Cell 8 was 2002 and the entire landfill was expected to reach capacity by 2019. The County continues to look for ways to extend the operating life of the Facility and to minimize the need to acquire additional landfill space.

Since 1995 the County has continued to evaluate numerous strategies to further extend the Landfill's life, and is implementing them as appropriate. They include:

- " the redirection of 350 tons/day to a regional transfer station for out-of-state disposal.
- " evaluation of municipal solid waste composting
- " evaluation of waste-to-energy facility diversion
- " implementation of a yard waste collection program for composting off-site
- " encouragement of curbside customers to recycle more, and to increase recycling above 30%.
- " encouragement of landfill and convenience center customers to source separate and recycle more
- " implementation of yard waste composting of self-hauled materials at the Facility

- " implementation of bioreactor project
- " evaluation of waste emerging technologies

Thus far, this strategy has reduced the waste entering the Facility from 800 tons/day in 1994 to 260 tons/day in 2000. As a result of the County's efforts to implement this strategy, Cell 8 is now projected to be able to accept waste until 2017 and Cell 9 until 2063. To date the County has evaluated all, and implemented most, of these waste handling strategies except the bioreactor concept.

C. Purpose of the Agreement

This Final Project Agreement is a joint statement of the plans, intentions, and commitments of the EPA, the MDE and the County to carry out this project at the County's Facility. This Project will be part of EPA's Project XL program to develop innovative approaches to environmental protection.

The Agreement does not create legal rights or obligations and is not an enforceable contract or a regulatory action such as a permit or a rule. This applies to both the substantive and the procedural provisions of this Agreement. While the Parties to the Agreement fully intend to follow these procedures, they are not legally obligated to do so by this document. For more detail, please refer to Section VI (Legal Basis for the Project Agreement).

Federal and State flexibility and enforceable commitments described in this Agreement will be implemented and become effective through one or more legal implementing mechanisms, such as a site specific rule and/or a permit or other regulatory amendment issued by EPA and/or the MDE.

All Parties to this Agreement will strive for a high level of cooperation, communication, and coordination to assure successful, effective, and efficient implementation of the Agreement and the Project.

D. List of the Parties that Will Sign the Agreement

The Parties to this Final Project XL Agreement are the United States Environmental Protection Agency, Maryland Department of the Environment, and Anne Arundel County Department of Public Works.

E. List of the Project Contacts

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II. Detailed Description of the Project

A. Summary of the Project

A bioreactor landfill is a sanitary landfill that enhances naturally occurring microbiological processes to transform and stabilize the decomposable organic waste within 5 to 10 years of implementation (compared to 30 to 100 years for dry Subtitle D landfills). Engineered bioreactor landfills can provide a more controlled means to reduce the environmental impacts of landfills on the surrounding local environment. Bioreactor techniques are gaining popularity in North America and Europe, and have been demonstrated at various landfills, particularly in areas where landfill closure is costly and/or where landfill siting is difficult. Engineered bioreactor landfills accelerate waste biodegradation, which is expected to: result in the recovery of capacity (air space); accelerate landfill gas generation rates; improve leachate quality; and shorten and lower the cost of long-term post-closure measures, potentially resulting in an earlier reuse of the land for other purposes. The viability and usefulness of these methods is supported by several other applications of bioreactor techniques elsewhere in the United States. A summary of some of these projects is presented in Table 1, and the benefits of these technologies are summarized in Table 2.

The County proposes to operate a small-scale, controlled, fully monitored, and evaluated bioreactor pilot project over a 3/4 acre plot within the Facility's Cell 8. The County has enlisted the assistance of Johns Hopkins School of Engineering for this project, and SCS Engineers will serve as the engineering consulting firm.

To implement the bioreactor pilot project, the County requests that EPA grant regulatory flexibility from certain RCRA provisions found in 40 CFR 258.28(a) and (a)(2). 40 CFR 258.28(a) restricts liquid waste introduction into landfills unless the waste is either household waste other than septic waste or leachate or gas condensate derived from the landfill. Under this EPA, the County proposes to recirculate leachate into a small portion of Cell 8. If the available leachate quantities are incapable of supplying the project needs (due to seasonal or other conditions), the County may supplement liquids being injected with onsite storm water runoff. 40 CFR 258.28(a)(2) provides that bulk liquids application is allowed only if the composite liner and leachate collection system is designed as prescribed in 40CFR 258.40 (a)(2). Since Cell 8

has been constructed with an alternate composite liner and collection system, 40 CFR 258.20(a)(2) prohibits leachate recirculation. (As mentioned above, the alternative system exceeds the performance requirements set forth at 40 CFR § 258.40 (a)(1)).

The County is aware that EPA's Project XL is being used to test bioreactor techniques at several other landfills across the country. The County believes that this project is different from these other projects, and will offer unique benefits, for several reasons, including:

- " Geography/climate The climate at the Facility is different from that at the other facilities, particularly with respect to the amount of rainfall that the sites receive. While the other landfills receive as little as 17 inches of rain annually, the Facility receives an average of 41 inches. This fact greatly impacts landfill gas generation and leachate formation as well as landfill settlement, and should affect how much liquid is necessary to achieve optimum biodegradation.
- " Unique waste stream The Facility receives a unique, moderately organic waste stream since a large percentage of curbside collected household waste is diverted to a regional transfer station. Thus this Project will provide valuable site-specific information concerning design, operations, and maintenance. One objective of this project is to determine the best method of injecting liquid that would lead to optimum effectiveness.

B. Specific project elements

The County's bioreactor pilot project will involve injecting a controlled amount of liquids through injection devices into a small portion of an individual subcell for up to a seven-year period (depending on effectiveness), and monitoring the settlement and LFG that results. The objectives of the project are as follows:

1. Design and construct a bioreactor test area in an active subcell of the Facility;
2. Perform liquid injection in a controlled manner using different injection methods;
3. Monitor surface settlement, injection rates and related parameters (Section III.G.) over a period of time; and
4. Evaluate results and ultimately identify the method that will most effectively increase the Facility's waste capacity.
5. Evaluate cost effectiveness of bioreactor techniques as a method of capacity creation.

The following subsections provide information on the proposed pilot design. Attachments IV, V, and VIII includes the drawings of the test area location, proposed system layout, and details of the supplemental LFG. Collection system (if required).

1. Test Area Location

The proposed test area measures 160 feet by 200 feet and is located within the southwestern portion of Subcell 8-4 (see Attachments IV and VIII). The waste volume in this area is approximately 95,500 cubic yards (waste depth from surface to liner is approximately 80 to 85 feet). The test area is a plateau with a 2 percent slope toward the landfill's side slope. The test area is adjacent to an existing haul road which makes it accessible to tank trucks for easier liquid injection. The County determined that this area had the best conditions for the bioreactor pilot project.

Subcell 8-4 began accepting MSW in October 1992. The site has accepted only small quantities of curbside MSW since 1997; it now accepts primarily construction debris. Thus the lowermost portion of the waste in Subcell 8-4 contains typical MSW, while the uppermost portion contains waste that is proportionately higher in construction debris and lower in decomposable organic materials. The County recently completed (summer 1999) a waste composition study to provide more detailed information about recent waste placement in the area of the proposed test. A March 1995 waste sort report will also be consulted.

The County used soil as a daily cover at the site until March 1993. Since then, the County has primarily used removable and reusable tarpaulins (tarps) throughout Cell 8 as the cover (approximately 97 percent of the time, depending on weather conditions). Previous use of tarps (rather than soil cover, for example) presents good conditions for a bioreactor study, as there is less potential for the creation of barriers (e.g., compacted soil cover) to limit vertical penetration of liquid into the waste mass.

The base liner for each constructed Subcell in Cell 8 is a double synthetic system consisting of the following, from top to bottom (refer to Attachment VI):

1. 2-foot protective soil cover over geotextile filter;
2. Leachate collection geonet drainage layer;
3. 60-mil high density polyethylene (HDPE) geomembrane top liner;
4. Leakage detection geonet drainage layer;
5. 60-mil HDPE geomembrane bottom liner; and
6. 1.5-foot low permeability (1×10^{-7} , cm/s, demonstrated by construction QA/QC) soil subbase.

(As mentioned, this liner system exceeds the performance requirements of the MDE and EPA for MSW landfills, and incorporates two geomembranes providing for leak detection, features typically associated with stricter hazardous waste landfill designs.)

The drainage portion of the liner system includes a 2-foot protective soil cover over geotextile filter over a geonet layer. This top 2-foot protective soil cover is comprised of a relatively high permeability soil with a saturated hydraulic conductivity of not less than 5×10^{-3}

cm/s. The combination of high permeable protective soil over geotextile filter that is installed throughout the landfill minimizes potential clogging caused by particulates in the leachate, biological growth, and biochemical reactions.

The leachate collection system in Cell 8 consists of one layer of geonet (part of the liner system described above) that covers the entire bottom of each landfill subcell and a system of perforated HDPE pipes placed in gravel blankets that overlay the geonet. Leachate is conveyed by the geonet and/or pipes to a sump, from which leachate is pumped and conveyed to an on-site leachate pretreatment facility. The leachate collection system at the landfill is designed specifically to keep a very small liquid depth on the top liner, and in any event less than the maximum 30 cm allowed under RCRA Subtitle D at all locations within a subcell, except at the sump where liquid is collected for pumping. In the sump areas of the landfill subcells, the liner system is enhanced by the addition of layers of geosynthetic clay liner (GCL) below both top and bottom geomembranes. The GCLs have saturated hydraulic conductivities of less than 1×10^{-9} cm/s. The GCLs together with the other liner components result in a double-composite liner system beneath the landfill sumps. To monitor the integrity of the top liner, the quantity of liquid removed from each subcell sump above the bottom liner (detection zone) is monitored on a daily basis. (The accumulation of some liquid due to condensation is expected and normal). The number calculated and established as a not to exceed guideline is 100 gallons per acre of subcell floor per day. Daily monitoring of the liquid above the bottom liner will continue throughout the life of Cell 8. To protect the drainage and liner system the initial eight-foot lift of waste is soft trash. Soft trash is solid waste that is collected from residential curbside trash pickups. No curbside waste may exceed four feet in length. Curbside household waste in general is softer than waste streams from commercial facilities or sources from homeowners self-hauling materials from their home or yard. This initial eight-foot lift of waste was compacted to six feet in thickness.

2. Liquid Injection

To improve the evaluation of different infiltration systems, the test area will include two vertical injection wells and two horizontal injection trenches. These are the two most commonly used and effective injection devices. The trenches will be excavated so that they slope away from the landfill side slopes at a 2 percent grade, to minimize excavation depths, promote gravity drainage, and eliminate possible (landfill) side-slope seepage. Design spacing for the wells and trenches minimize overlapping areas of influence. This spacing will reduce uncertainties that may be introduced by overlapping influences.

The injection devices are designed to maximize the amount of liquid that can be injected; however, actual injection rates will be varied in response to information learned from the degree of infiltration and resulting settlement. The vertical wells consist of slotted or perforated 6-inch diameter pipe centered in a 3-foot diameter borehole and backfilled with high permeability stone. The well depths will be selected to penetrate between one-third and one-half the overall waste depth. The horizontal trenches will consist of 6-inch diameter perforated or slotted pipe centered in a 2 x 1.5-foot trench, backfilled with high permeability stone or gravel. Proprietary leachate pipe products that are relatively new to the waste industry may also be considered. Design details of the proposed vertical wells and horizontal trenches are shown in Attachment V.

Each injection device will be fed from a centrally located 6,500 gallon tank truck through a single hose connection. A flow meter will be installed to allow measurement of liquid flow to each injection device. Four control valves will be installed to allow independent flow regulation to each of the injection ports. A central feed location will be used to ease system operations and reduce truck traffic that may affect settlement rates. Finally, precipitation will be recorded via a rain gauge to allow for adjustments to the injection rate. As noted above, at no time will more than 30 cm of leachate be permitted to collect over the liner.

3. Settlement Plates

Prior to system startup, the County will install monuments (settlement plates) to monitor settlement caused by the degradation of the waste. These settlement plates will be strategically located around wells and trenches to measure surface movements during the study (refer to the Layout in Attachment V). Plates will consist of 4-6 inch diameter concrete or wooden posts embedded at least 2 feet into the upper surface of the waste. If necessary, they will be grouted in place. The top elevation of each plate will be surveyed prior to liquid injection. The County plans to monitor these settlement plates at least monthly, but will do so more frequently if information suggests that settlement is occurring at a rapid rate. At least one plate will be located in a control area that is adjacent to the test area and outside the zone of influence for the liquid injection system. This control area will measure normal settlement rates as a comparison. Additionally, a stable elevation benchmark will be established to ensure that all readings are based on the same baseline elevation. Annual aerial topographic surveys will also be performed to aid in the evaluation of settlement and the effectiveness of the leachate recirculation.

4. Landfill Gas Considerations

The design capacity of the Facility's Subtitle D landfill exceeds the New Source Performance Standard (NSPS) thresholds, and thus the facility must comply with 40 CFR Part 60 Subpart WWW. Cell 8 currently operates under an Alternate Operating Scenario (AOS) approved by the State of Maryland under its NSPS Program, and the County has included the AOS in its application for a Part 70 Permit (also known as a Title V permit) under the federal Clean Air Act (hereinafter referred to as the Title V Permit). The AOS provides that at Cell 8 LFG is collected via existing leachate collection system components, rather than from separate LFG extraction wells and/or trenches. The AOS also postpones the requirement for quarterly measurement of surface methane emissions under 40 CFR Part 60 Subpart WWW. (Note that the AOS applies to Cell 8 only. Each of the other Cells is part of an active LFG collection system comprising separate extraction wells and/or trenches, and are monitored quarterly for LFG).

Recognizing that liquids addition enhances the generation of LFG, the County agrees to take all necessary steps to control, and monitor, LFG in the area of the bioreactor experiment. To accomplish these steps, and as further detailed below, the County 1) will request an amendment to its AOS under which it will be required to conduct quarterly surface methane emissions monitoring, beginning with a baseline measurement taken prior to the first introduction of liquids, and 2) in accord with the requested amendment will, as the project progresses, evaluate the need to install additional LFG control devices, in the area of the bioreactor project in accordance with the NSPS for municipal landfills, 40 CFR Part 60 Subpart WWW. (A copy of

the County's proposed requested amendment is attached as Att. IV.) The County will undertake additional LFG response measures in accord with Part WWW if methane surface emissions exceed 500 ppm or if significant odors from the test area are observed. The potential for surface emissions is likely to be greatest in the immediate area of liquids injection. (See Att. VIII, SCS analysis of impact of bioreactor project on LFG production.)

LFG Monitoring

The County will monitor surface emissions over the entire plateau area that includes (but is not limited to) the test area. (Instrumentation type and frequency is set forth in Tables 4 & 5.) This plateau area measures 180 feet by 300 feet and is essentially centered on the test area and borders the landfill side slope (see Attachment IV, Att. 2; Att. VIII). (Note that the landfill side slope is covered with a clayey intermediate cap (hydraulic conductivity of about 10^{-4} to 10^{-5} cm/s), reducing the potential for side slope surface emissions; and that the integrity of the side slope cap is maintained with vegetative growth.) Surface monitoring in the above-mentioned plateau area will be conducted in accordance with 40 CFR Part 60 Subpart WWW (See also Tables 4 & 5).

LFG Control

Prior to the introduction of liquids under this Project, a baseline surface methane concentration level will be obtained to establish the baseline performance of the current gas collection and control system located in the test cell. Subsequent surface methane concentrations will be undertaken according to the requirements in 40 CFR Part 60 Subpart WWW. If any quarterly surface monitoring shows a surface methane concentration that exceeds 500 ppm over the test area plateau or if significant odors are found to be emanating from the test area, the County will take corrective actions (which may include installation and operation of additional LFG collection and control technology) as provided in 40 CFR § 60.755. Such additional LFG collection and control technology may include either passive LFG collection technology (*i.e.* independently of the existing active LFG collection system, using candlestick flares) or active LFG collection technology (*i.e.* connected to the existing active LFG collection system. In any event, the LFG collection and control measures (including any supplemental measures undertaken in the area of the Test Area) will be run continuously if sufficient gas is present to sustain combustion, and shall otherwise be operated in accordance with 40 CFR Part 60 Subpart WWW. If and when the County undertakes such supplemental LFG collection measures, the County will undertake continuous gasflow rate monitoring of the gas collected from the plateau area of Subcell 8.4.

5. Liquids Monitoring

The quantity of leachate, and supplemental water (if required), added back to the landfill will be measured throughout the life of the project. The County expects to measure recirculation quantities using flow meters installed on the leachate receptacle just prior to the distribution system piping and valves.

As discussed previously, the leachate collection/drainage layer constructed in each subcell consists of two feet of high permeability sand over a geonet drainage layer. Due to the

internal subcell slopes and high permeability of the drainage layer, the County expects that there will be very little head buildup on the liner notwithstanding the increased levels of liquids. As noted above, the leachate collection system is designed to maintain a head significantly less than the maximum 30 cm allowed under 40 C.F.R. § 258.28(a)(2)) at all locations within a subcell, except at the sump where liquid is collected for pumping. Leachate recirculation will be suspended if there appears to be head build up, and in any event the head will not be allowed to exceed 30 cm.

Studies of bioreactor techniques have documented the improvement in leachate quality that results from liquids addition. See Attachment VII for Leachate Analytical Results. This is an important environmental benefit of the project, both because it would indicate that the waste mass is stabilizing, and because of the lessened requirements for treatment. Since leachate is pumped from each subcell individually, the County intends to sample the leachate from subcells 8-4 (test cell) and 8-6 (control cell) semi-annually for parameters that will help establish whether or not leachate quality is indeed improving in Subcell 8-4.

6. Protection Against Landfill fires

Fires in landfills are usually caused by poorly designed or operated active LFG collection systems that allow ambient air into the waste. For this project, the LFG collection system will be carefully operated to handle excess gas generated while minimizing the potential for landfill fires. The potential for landfill fires will also be minimized for this project since it is based on the anaerobic bioreactor concept.

III. How the Project Will Meet the XL Criteria

A. Superior Environmental Performance

The main goal of this project is to develop information regarding the degree to which different methodologies for liquids introduction could bring about the environmental benefits listed below which are typically associated with use of bioreactor techniques. If the pilot project in Subcell 8-4 is successful, the County hopes to expand the use of successful bioreactor techniques to other subcells in Cell 8 and Cell 9 at the Facility. (As noted above, such broader use of bioreactor techniques at the Facility is beyond the scope of this Agreement, and would require further regulatory amendment.)

Environmental benefits of bioreactor techniques generally include:

- a. Reduced need for construction of new landfills and corresponding reduction (or elimination) of the land, air, and water impacts associated with landfill construction;
- b. Decreased concentration of most leachate constituents as cycling of leachate removes or reduces contaminants;
- c. Reduction in the amount of leachate requiring pretreatment;

- d. Reduction in post-closure care, maintenance and risk (bioreactor landfills minimize long-term environmental risk and liability due to the controlled settlement of the solid waste during landfill operation, low potential for leachate migration into the subsurface environment, and the recovery of LFG during operation); and
- e. Reduction in the amount of leachate that the facility discharges to the local wastewater treatment plant, and subsequent discharge of effluent to the Patuxent River.

1. Tier 1: The Project is Equivalent

To adequately measure the environmental and other benefits of the proposed bioreactor pilot project, the County will set a baseline that records the environmental impacts of the Facility without the proposed bioreactor project. Without the project, Subcell 8-4 will be filled until it reaches its capacity, and then covered. The remainder of the Subcells in Cell 8 will also be filled until the Facility reaches its capacity. After that time, Cell 8 will be closed and the County will develop Cell 9. It will also continue to generate the same levels of leachate for disposal to the local Publicly Owned Treatment Works (POTW).

Table 3 outlines a comparison of the baseline project to a full-scale bioreactor project. This particular XL project will provide environmental performance at least equivalent to Tier 1 in all areas.

2. Tier 2: Superior Environmental Performance

Leachate recirculation, even over the limited test cell area, promises more rapid leachate stabilization in terms of pollutant load, reduced leachate environmental impact, and elimination of need for most discharges of leachate to treatment facilities. The biological processes within land filled wastes, which are enhanced by the recirculation of leachate, have been shown in studies at many scales to reduce the concentration of many leachate pollutants, including organic acids and other soluble organic pollutants. (See Table 1.) Since a biologically active landfill operation brings pH to near-neutral conditions, metals of concern are largely precipitated and sequestered/ immobilized in waste. Thus free liquid concentrations and mobility of metals are reduced compared to "conventional" landfill practices, where lower-pH leachate is often observed to be generated slowly for years. In sum, the need for off-site leachate treatment should be reduced under this Project.

With the bioreactor pilot project, the Facility is expected to gain valuable information about whether bioreactor techniques might create additional airspace, and additional years of landfill life. If the pilot project in Subcell 8-4 is successful, the County would like to expand the use of bioreactor technology to other subcells in Cell 8 and Cell 9 at the Facility site, thus further extending the landfill's useful life. (As noted above, such broader use of bioreactor techniques at the Facility is beyond the scope of this Agreement, and would require further regulatory amendment.)

3. How the Superior Environmental Performance Will Be Measured

Superior Environmental Performance (SEP) will be measured using the baseline (Tier 1, without Project XL) against the actual results of the project (Tier 2, proposed Project XL). To determine specific bioreactor performance attributes, monitoring parameters are listed in Table 5. SEP will be measured in the following areas: amount and concentration of leachate disposed to the local POTW; amount of landfill settlement; and new information gained.

Additionally, as noted above, MDE - Air and Radiation Management Administration (MDE-ARMA) has approved an Alternate Operating System (AOS) for all of Cell 8 which permits an alternative form of LFG collection, and which postpones quarterly monitoring. The County intends to submit Addendum #1 to the AOS to MDE (copy attached as Att. IV), which, if and when adopted, will require, inter alia, monitoring of LFG parameters sufficient to assess and to compare emission performance of the bioreactor to the conventional landfilling techniques. NSPS emission guideline method (section 60.755 (c)3) will be used to measure surface emission. Monitoring of system performance will include quarterly surface methane emissions testing to track and confirm the collection effectiveness of the LFG collection system. Monitoring will continue for the duration of the project, as provided in the proposed Addendum #1.

It is well documented in the literature and from operating leachate recirculation/gas recovery landfills that accelerated gas generation will occur in these types of landfills. The supplemental LFG collection system for the project will be designed to collect and control LFG in accord with 40 CFR Part 60 Subpart WWW.

Measurement of additional waste disposal airspace through settlement will be based on annual aerial topographical surveys. Total volume loss occurring within this time interval will be calculated.

The County will measure leachate quality over time to examine changes and trends in leachate quality. The County will compare its results with similar, non-recirculating subcells (8.1, 8.2, 8.3, 8.5, and 8.6).

C. Stakeholder Involvement and Support

Public outreach and education are essential functions of any significant project at the Facility. The County has included all relevant sectors as stakeholders in this project. Those entities the County feels may desire notification, but do not participate, will be provided information on the project.

Stakeholder Identification

The County has a history of involving the appropriate stakeholders in projects at its solid waste acceptance or disposal facilities. This philosophy has proved to be beneficial to all involved parties. The County plans to continue this philosophy for this project.

The County has divided the stakeholders into three groups. The groups are identified as primary stakeholders, potential interested parties, and members of the general public.

Primary Stakeholders

- " U.S. Environmental Protection Agency (EPA)
- " Maryland Department of the Environment, Solid Waste Program
- " Anne Arundel County Health Department, Environmental Health Bureau
- " Anne Arundel County, Planning and Code Enforcement
- " Anne Arundel County, Soil Conservation District
- " Others as may be identified

The primary stakeholders are the regulatory agencies involved with solid waste disposal facilities or other activities at the disposal site. These primary stakeholders will have active participation in the project proposal and project development.

Potentially Interested Partners

- " John Hopkins University, Department of Environmental Engineering
- " Solid Waste Association of North America (SWANA)
- " Geosyntec Consultants
- " Heery International
- " Carroll County, Maryland
- " Private Sector, waste disposal companies
- " Others as may be identified

The potentially interested partners may express interest in the project and have some involvement in the project. It is not anticipated that all partners will play an active and ongoing role in project development. If they do not actively participate in the project, they will be kept informed of the project's progress at appropriate milestones. Their input will be welcomed in verbal or written form.

General Public

The facility neighbors will be advised of the project through routine Community Update Newsletters. Details of this project were presented in the Sept. 1, 2000 Community Update Newsletter. The general public will be provided information on the Final Project Agreement (FPA) through the local media (Capital newspaper).

The County will actively solicit comments from the primary stakeholders and potentially interested partners. The County envisions 4 - 6 meetings at appropriate times:

- " Upon release of the FPA
- " One year after project field initiation.
- " Update after completion of each year of project
- " Final meeting at the end of project

The County remains open to new interested stakeholders/participants that may be identified as the project progresses. The County will continue to provide stakeholders and members of the general public with updated information on the project via its Department of

Public Works website and newsletters so that they may have an opportunity to monitor the project's progress towards meeting its goal of superior environmental performance. The County may develop and publish fact sheets and other informative outreach documents to further educate the landfill neighbors about this innovative project.

D. Innovative Approaches and Multi-media Pollution Prevention

The key innovation delivered by the Millersville Landfill Bioreactor pilot project is the information it will provide about the potential for leachate recirculation to increase landfill waste settlement. If the pilot project is successful in demonstrating that accelerated waste settlement can be achieved in a cost-effective manner, the County intends to attempt to implement other bioreactor projects on a wider scale, which could lead to a significant pollution prevention benefit in the avoidance of new landfill siting and construction in the County. Another significant pollution prevention benefit from this Project is the fact that any leachate which ultimately does require offsite disposal should be substantially less contaminated with pollutants. Moreover, should the liner ever fail, the impact of any potential leachate release would be substantially lessened.

E. Transferability of the Approach to Other Entities or Sectors

The County believes that if the pilot project successfully achieves low-cost landfill settlement, it will have a high degree of transferability, as it requires a relatively simple technology and a relatively minor degree of regulatory flexibility. This project will also provide critical public information about the viability of bioreactors in the Mid-Atlantic United States. Further, because the siting of new landfills requires a significant public investment of time and resources, other jurisdictions in Maryland and elsewhere will be able to use the County's results to help them decide whether to pursue similar bioreactor projects. The County's publication of its experiences under this project will also provide valuable data on the performance of different types of injection devices for controlled degradation of waste.

Following an evaluation of this XL Project by EPA, and assuming its overall success, the leachate recirculation/gas recovery landfill technology used could be transferable to landfills where conditions are favorable for actively managing the decomposition process while ensuring groundwater protection and gas control.

F. Feasibility of the Project

The bioreactor concept has already been tested at the Yolo County project, and at other sites in North America and Europe. (See Table 1.) It has been shown that the technology can feasibly create additional airspace at a landfill. The County has already consulted with the MDE about the proposed project, and MDE supports this proposal. Further, the County has set aside the necessary budgeted funds to implement this project.

The project sponsor, primary stakeholders, and regulatory agencies as designated in the Final Project Agreement, agree to support the project, subject to any review procedures necessary to implement the legal mechanism for this project. Further, the XL participant has the financial capability, personnel and senior management commitment necessary to implement the elements

of this XL Project.

G. Monitoring, Reporting, Accountability, and Evaluation of Methods to be Used

The County plans to develop a tracking methodology that involves collecting the following data:

- " Amount of liquid injected via horizontal trenches and vertical wells
- " The amount of treated leachate that is discharged to the local POTW (to determine if there is a decrease)
- " Characteristics and amount of LFG (e.g., CH₄, CO₂, O₂, and N₂)
- " Concentration of leachate constituents and general chemistry parameters (e.g., BOD, COD, pH, conductivity, and TDS).
- " Amount of landfill settlement achieved
- " Cost of project

Leachate samples were collected from each subcell sump in March 1998, June 1998, October 1998, October 1999, and October 2000. These samples were analyzed for a full array of parameters including volatile organic compounds, total metals and general chemistry parameters (refer to Attachment VII). This establishes a baseline for leachate quality.

The project's status will be monitored and reported on a semi-annual basis to the EPA, MDE, and other stakeholders. Updates to the DPW's website concerning this Project will be made at least semi-annually. An annual meeting among the stakeholders will be held to review the project progress and results to date for as long as the County continues to recirculate leachate at its site under the provisions of the site specific rule(s) promulgated to implement this XL project. This outreach will be designed to enable stakeholders to assess the project's success in achieving SEP.

Monitoring will continue for the duration of the project, and longer to the extent required by the Facility's applicable state permit(s).

Accountability

As mentioned previously, the County has included bioreactor landfilling as one part of its County-wide Solid Waste Management Strategy, and the project has the required County approvals to move forward. The County has a Solid Waste Enterprise Fund that has provided the necessary funding to support the pilot project. Funding is initially dedicated at \$122,000 for the design and construction portions of this project. Operation of the project is estimated to cost approximately \$25,000/year.

The Parties intend to implement as enforceable commitments, federal and state regulatory flexibility, monitoring, record-keeping, and reporting provisions of this FPA through a site-specific rule under RCRA, and through the County's Title V permit for the Landfill, issued by MDE under the federal Clean Air Act. The Title V permit will contain enforceable parameters and requirements with respect to NSPS-compliant gas collection and monitoring, which will be implemented prior to liquid additions and/or leachate recirculation, whichever occurs first. The

Title V Permit will be issued after a public notice and comment period. In addition, EPA expects to issue a proposed rule which would allow liquid additions at the Facility, which will also require a public comment period. Either the Title V permit or the site-specific rule (as appropriate) will contain the enforceable project monitoring requirements listed in Table 5, and would require that the County provide semi-annual reporting of the monitoring to EPA and MDE (hereinafter the "regulators") in order to facilitate project evaluation.

EPA and MDE will assess the project annually based on all information submitted by the County. EPA will post a summary of the County's project data on its Project XL web page semi-annually.

Additionally, the County commits to providing the following information to project stakeholders and regulators in order to facilitate a comprehensive project evaluation:

- " Semi-annual reports of quantities of leachate and other bulk liquids circulated in subcell 8.4.
- " Semi-annual reports on changes in the quality of the leachate in subcells 8.4 and 8.6.
- " Semi-annual reporting on settlement as measured against monuments installed for this purpose.
- " Annual reporting and assessment of the settlement in the test area based upon topographic surveys.
- " Quarterly monitoring of surface methane emissions

Information submitted for both the mandatory and voluntary reporting elements for this project will be considered and assessed annually by EPA and the State.

H. Avoidance of Shifting of Risk Burden to Other Areas or Media

The enforceable monitoring requirements described above will ensure that there will be no shifting of risk burden to other environmental media associated with this project. In the unlikely event that the alternate liner system does not perform sufficiently under recirculation conditions, the underlying leak detection monitoring zone (i.e., the lined area beneath the sump areas and liner systems in the subcell) will be able to detect a release early, collect the release, and form the basis for project suspension. The leak detection zone will serve to collect any release of contaminants before they reach the soils and groundwater beneath the landfill.

As set forth elsewhere in this Agreement (see Sec. II.B.4.), the County will conduct quarterly surface emissions monitoring under 40 CFR Part 60 Subpart WWW in accord with its revised AOS to assure that no additional burden of air emissions has occurred from within the test area.

In addition, this project would not entail a shifting of environmental risk to low-income

or disadvantaged communities. Instead, it reduces that risk. The expected result of the project is the eventual delay or avoidance of new landfill construction.

IV. Description of the Requested Flexibility and Implementing Mechanisms

A. Requested Flexibility

This section is intended to describe the federal and state regulatory flexibility needed for this XL project. To the extent such action is necessary and appropriate, it will be provided as part of this project and subject to public notice and comment.

In general, the County proposes to undertake a proposed bioreactor landfill project within the limitations established in this XL agreement. The County is requesting specific flexibility under the current federal regulations requirements for liquid addition as described below. Additionally, the County has agreed to request, and have incorporated, certain changes in its Title V air permit applicable to the Facility.

As described in Section II, the addition of bulk liquids over a portion of Subcell 8-4 is expected to enhance the biological degradation of waste in the landfill. As part of the proposal, the County is requesting that the USEPA grant regulatory flexibility from the requirement of the RCRA that restricts application of bulk liquids in MSW landfills presented in 40 CFR 258.28(a), which provides as follows.

- " It permits the addition of leachate or gas condensate, provided the landfill unit is designed with a composite liner and leachate collection system as described in 40 C.F.R. § 258.40(a)(2).
- " It prohibits the placement of liquid wastes other than leachate, gas condensate, and non-septic household waste in any MSW landfill.
- " It permits the addition of septic waste

Since the liner with which the Facility was constructed meets the performance, but not design, standard set forth in C.F.R. § 258.40(a)(2), regulatory flexibility is needed to allow recirculation of leachate over it. Additionally, RCRA prohibits the placement of liquid waste other than leachate/gas condensate and non septic household waste in any MSW landfill. Therefore the County needs regulatory change in order to add storm water to Subcell 8-4 of the Facility.

Regarding LFG, a LFG collection system is already in operation at Cell 8. The County's Title V Permit application will incorporate the County's AOS as revised, which in turn will provide that prior to the introduction of liquids under this project, a baseline surface methane concentration level will be obtained to establish the baseline performance of the current gas collection and control system located in the test cell. Subsequent surface methane concentrations will be checked according to the requirements in 40 CFR Part 60 Subpart WWW. If the quarterly surface monitoring establishes a surface methane concentration in exceedance of 500 ppm over the test area plateau or if significant odors are found to be emanating from the test area,

the County will take corrective action (which may include installation and operation of additional LFG collection and control technology) as provided in 40 CFR § 60.755. In any event, the LFG collection and control measures (including any supplemental measures undertaken in the area of the Test Area) will be run continuously if sufficient gas is present to sustain combustion, and shall otherwise be operated in accordance with 40 CFR Part 60 Subpart WWW.

The County will comply with all other applicable environmental requirements. The County will submit an application to MDE requesting an amendment to its AOS for Cell 8, and which amendment (when granted) will be incorporated into the County's Title V permit. (A copy of the County's proposed requested amendment is attached as Att. IV.)

In signing this agreement MDE affirms that it is supportive of the bioreactor concept.

Without regulatory flexibility, the County would not be able to test the economic and environmental viability of the bioreactor technology at its facility.

B. Legal Implementing Mechanisms

To implement this Project, the Parties intend to take the following steps:

1. EPA expects to propose for public comment and take final action on a site-specific rule amending 40 CFR 258.28, applicable to Anne Arundel County's Millersville Landfill and Resource Recovery Facility. This site-specific rule will describe the project requirements and any other aspects of the rulemaking. It is expected that the site-specific rule will provide for Withdrawal or Termination and a Post-Project Compliance Period consistent with Section VII, and will address the Transfer procedures included in Section X.

2. The State of Maryland under its relevant authority expects to modify any permits necessary to implement this FPA. As noted above, the County will submit an amendment to its Title V Permit application which will incorporate its obligations to monitor and control LFG generated by this Project (see Att. IV.)

3. The standards and reporting requirements set forth in Section III (and any attachments to this FPA) will be implemented in this site-specific rulemaking. The monitoring, record keeping, and reporting requirements will be incorporated in the Title V permit.

4. Except as provided in any rule(s), permit provisions or other implementing mechanisms that may be adopted to implement the Project, the Parties do not intend that this FPA will modify or otherwise alter the applicability of existing or future laws or regulations to the County's Facility.

5. By signing this FPA, EPA, the County, and the MDE acknowledge and agree that they have the respective authorities and discretion to enter into this FPA and to implement the provisions of this project, to the extent appropriate.

V. Discussion of Intentions and Commitments for Implementing the Project

A. Anne Arundel County's Intentions and Commitments

1. Enforceable

The County will comply with all applicable environmental requirements during implementation of this Project.

The County will establish a record keeping system to ensure compliance, as well as accurate reporting of monitoring data generated in accord with Table 5.

Anne Arundel County will submit an application to the MDE - ARMA requesting an amendment to its AOS under which it will be required to conduct quarterly surface methane emissions monitoring, and to install additional LFG control devices, in the area of the bioreactor project accordance with the NSPS for municipal landfills, 40 CFR Part 60 Subpart WWW. (See Att. IV.) The parties intend that the modified AOS will be incorporated into the County's Title V permit, which in turn will incorporate all of the landfill gas monitoring requirements specified in Table 5 of this agreement and will contain adequate provisions to ensure that landfill gas generated as a result of this Project will be collected and controlled in accordance with the requirements of 40 CFR, part 60, Subpart WWW. The County will work diligently with MDE to ensure that the Title V permit is issued in a timely manner.

In accord with the site specific RCRA rule, the County will provide accurate data for the proposed bioreactor landfill. This data should enable EPA and the State to develop or modify regulatory requirements for identified parameters, including those identified in Table 5 of this FPA.

2. Voluntary

The County proposes to operate a portion of Subcell 8-4 as a bioreactor landfill pilot to attain a number of superior environmental and cost savings benefits.

The County may request to expand the area in which it is using bioreactor techniques in the future if the pilot project is successful.

The County is committed to working with federal, state, and local governments to demonstrate, with regulatory flexibility allowing recirculation over subcells constructed with alternative liners and the addition of supplemental water (if needed), how a leachate recirculation/gas collection landfill can demonstrate more desirable environmental results than a conventional landfill.

The County intends to continue to provide resources to maintain the schedules set forth in this FPA.

The County intends to provide annual reporting of the monitoring to the stakeholders to facilitate project evaluation.

B. EPA s and the State of Maryland s Intentions and Commitments

EPA intends to propose and issue (subject to applicable procedures and review of public comments) a site-specific rule, amending 40 CFR Part 258.28 for the County to allow recirculation of leachate over subcell 8.4 constructed with an alternative liner and to allow the addition of supplemental storm water from the on-site ponds should leachate availability become limited, that applies specifically to the County s Facility. The site-specific rule will also provide for withdrawal or termination and a post-Project compliance period consistent with Section XII of this Agreement, and will address the transfer procedures included in Section IX. Monitoring, record keeping, and reporting requirements will be implemented in the site-specific rule. EPA will work with other Parties, stakeholders and the appropriate local, regional, state and federal agencies to facilitate the process.

EPA will propose a site-specific rule under RCRA to facilitate the implementation of this pilot project by providing regulatory flexibility for liquid additions into existing Subcell 8-4.

EPA will review the Project annually to determine whether it is resulting in superior environmental performance.

EPA and the other regulatory agencies will review and assess annual and periodic reports submitted by the County. Based on periodic review of the pilot project, the Parties, in consultation with the stakeholders, EPA will determine whether the pilot program is successfully exhibiting the superior environmental performance anticipated at this time and that no detrimental results (such as the alternative liner failing to perform as anticipated, or unsatisfactory performance of the gas collection or monitoring strategy) have been exhibited during the pilot project, then EPA and Maryland may extend the regulatory flexibility described under this FPA to future subcells and cells at the County project site. EPA will also take into account any relevant amendments to the regulations in 40 CFR Part 258 that concern addition of liquids to MSWLFs or landfill gas collection/ monitoring requirements. EPA expects that such amendments would supercede the site-specific rule and would apply to future landfill subcells or cells at the Facility.

The State and other local governing regulatory agencies will assist the XL Project Team in understanding all applicable regulatory and/or permitting requirements for the Project, and evaluate any need for regulatory flexibility openly with the Team.

The MDE-ARMA under its relevant authority expects to modify any permits necessary to implement this FPA. The monitoring, record keeping, and reporting requirements will be included in the Title V Permit.

C. Project XL Performance Targets

The performance targets of this project will be to achieve the superior environmental performance described in Section III, G of this FPA in Table 2. It describes some of the measures that will be used. Others may be developed as part of the permitting processes and the associated stakeholder involvement.

D. Proposed Schedule and Milestones

This project will be developed and implemented over a time period necessary to complete its desired major objectives, beginning from the date that the final legal mechanism becomes effective, unless it is terminated earlier or extended by agreement of all Project Signatories. Assuming that a Final Project Agreement is executed by December, 2000, the County intends to begin final design of the system and have it complete by January 2001. At that time, the final design will be submitted to MDE and to EPA for verification of consistency with the Final Project Agreement. It is expected that MDE concurrence can be accomplished within one month at which time construction of the leachate recirculation/gas recovery system will commence. It is expected that the system will be operational by the Spring/Summer of 2001.

E. Project Tracking, Reporting and Evaluation

The project tracking, reporting and evaluation will be accomplished for the project in accord with this FPA (see Section III. G. Monitoring, Reporting, Accountability, and Evaluation of Methods to be Used). The County may provide periodic updates of project performance at nationally recognized solid waste symposiums, subject to acceptance by those symposia.

F. Periodic Review by the Parties to the Agreement

The Parties will hold periodic performance review conferences to assess their progress in implementing this Project. Unless they agree otherwise, the date for those conferences will be concurrent with annual Stakeholder Meetings. No later than thirty (30) days following a periodic performance review conference, the County will provide a summary of the minutes of that conference to all Primary Stakeholders. Any additional comments from other interested partners or other parties will be provided to EPA.

G. Duration of the Project

Under the terms of this pilot project, the Anne Arundel County Department of Public Works will be authorized to recirculate leachate in subcell 8-4 for up to seven years from the effective date of the legal implementation mechanisms described in this FPA, and will be required to collect and monitor landfill gas for one year following the cessation of liquid recirculation at the test site if leachate is recirculated for six years or less. If the County circulates leachate for longer than six years, then the County will be required to collect and monitor landfill gas through the full seven year term of the Project. It is expected that the sponsor will continue to implement the project in good faith for the full seven years unless either party seeks to withdraw from or terminate this Agreement in accordance with the terms set out in Section XI of this FPA. The County will continue to be obliged to meet the requirements of all legal implementation mechanisms, including permit requirements, until such time as these requirements are legally modified in accordance with the procedures described in Section XII of this FPA.

At any time following a determination by the project stakeholders that the pilot project has produced the anticipated superior environmental performance as described in this FPA, the

County may request authorization from EPA and MDE to expand the bioreactor system to future subcells or cells under similar terms. The Parties recognize that the granting of any such request will require an amendment to this FPA in accordance with the terms of Section VIII of this FPA (Amendments or Modifications to the Agreement), and further regulatory amendments.

VI. Legal Basis for the Project

A. Authority to Enter into the Agreement

By signing this Agreement, all signatories acknowledge and agree that they have the respective authorities, discretion, and resources to enter into this Agreement and to implement all applicable provisions of this Project, as described in this Agreement.

B. Legal Effect of the Agreement

This Agreement states the intentions of the Parties with respect to the County's XL Project. The Parties have stated their intentions seriously and in good faith, and expect to carry out their stated intentions. This Agreement in itself does not create or modify legal rights or obligations, is not a contract or a regulatory action, such as a permit or a rule, and is not legally binding or enforceable against any Party. Rather, it expresses the plans and intentions of the Parties without making those plans and intentions binding requirements. This applies to the provisions of this Agreement that concern procedural as well as substantive matters. Thus, for example, the Agreement establishes procedures that the Parties intend to follow with respect to dispute resolution and termination (see Sections X and XI). However, while the Parties fully intend to adhere to these procedures, they are not legally obligated to do so.

EPA intends to propose for public comment a site-specific rule needed to implement this Project. Any rules, permit modifications or legal mechanisms that implement this Project will be effective and enforceable as provided under applicable law.

This Agreement is not a "final agency action" by EPA, because it does not create or modify legal rights or obligations and is not legally enforceable. This Agreement itself is not subject to judicial review or enforcement. Nothing any Party does or does not do that deviates from a provision of this Agreement, or that is alleged to deviate from a provision of this Agreement, can serve as the sole basis for any claim for damages, compensation or other relief against any Party.

C. Other Laws or Regulations That May Apply

Except as provided in the legal implementing mechanisms for this Project, the Parties do not intend that this Final Project Agreement will modify the applicability of any other existing or future laws or regulations.

D. Retention of Rights to Other Legal Remedies

Except as expressly provided in the legal implementing mechanisms described in Section IV, nothing in this Agreement affects or limits the County's, EPA's, the State of Maryland's, or

any other signatory's legal rights. These rights include legal, equitable, civil, criminal or administrative claims or other relief regarding the enforcement of present or future applicable federal and state laws, rules, regulations or permits with respect to the facility.

Although the County does not intend to challenge agency actions implementing the Project (including any rule amendments or adoptions, permit actions, or other action) that are consistent with this Agreement, the County reserves any right it may have to appeal or otherwise challenge any EPA, State of Maryland, or local agency action to implement the Project. With regard to the legal implementing mechanisms, nothing in this Agreement is intended to limit the County's right to administrative or judicial appeal or review of those legal mechanisms, in accordance with the applicable procedures for such review.

VII. Unavoidable Delay During Project Implementation

Unavoidable delay" (for purposes of this Agreement) means any event beyond the control of any Party that causes delays or prevents the implementation of the Project described in this Agreement, despite the Parties' best efforts to put their intentions into effect. An unavoidable delay can be caused by, for example, a fire or acts of war, or permitting delays at the State level.

When any event occurs that may delay or prevent the implementation of this Project, whether or not it is avoidable, the Party to this Agreement who knows about it will immediately provide notice to the remaining Parties. Within ten (10) days after that initial notice, the Party should confirm the event in writing. The confirming notice should include: 1) the reason for the delay; 2) the anticipated duration; 3) all actions taken to prevent or minimize the delay; and 4) why the delay was considered unavoidable, accompanied by appropriate documentation.

If the Parties agree that the delay is unavoidable, relevant parts of the Project schedule (see Section V.) will be extended to cover the time period lost due to the delay. If they agree, they will also document their agreement in a written amendment to this Agreement. If the Parties do not agree, then they will follow the provisions for Dispute Resolution outlined below.

This section applies only to provisions of this Agreement that are not implemented by legal implementing mechanisms. Legal mechanisms, such as permit provisions or rules, will be subject to modification or enforcement as provided under applicable law.

VIII. Amendments or Modifications to the Agreement

This Project is a research project designed to test new approaches to environmental protection and there is a degree of uncertainty regarding the environmental benefits and costs associated with activities to be undertaken in this Project. Therefore, it may be appropriate to amend this Agreement at some point during its duration.

This Final Project Agreement may be amended by mutual agreement of all Parties at any time during the duration of the Project. The Parties recognize that amendments to this Agreement may also necessitate modification of legal implementation mechanisms or may require development of new implementation mechanisms. If the Agreement is amended, EPA

and the County expect to work together with other regulatory bodies and stakeholders to identify and pursue any necessary modifications or additions to the implementation mechanisms in accordance with applicable procedures (including public notice and comment). If the Parties agree to make a substantial amendment to this Agreement, the general public will receive notice of the amendment and be given an opportunity to participate in the process, as appropriate.

In determining whether to amend the Agreement, the Parties will evaluate whether the proposed amendment meets Project XL acceptance criteria and any other relevant considerations agreed on by the Parties. All Parties to the Agreement will meet within ninety (90) days following submission of any amendment proposal (or within a shorter or longer period if all Parties agree) to discuss evaluation of the proposed amendment. If all Parties support the proposed amendment, the Parties will (after appropriate stakeholder involvement) amend the Agreement.

IX. Transfer of Project Benefits and Responsibilities to a New Owner

The Parties expect that the implementing mechanisms will allow for a transfer of the County's benefits and responsibilities under the Project to any future owner or operator upon request of County and the new owner or operator, provided that the following conditions are met:

A. The County will provide written notice of any such proposed transfer to the EPA, the State of Maryland, and all applicable local agencies at least ninety (90) days before the effective date of the transfer. The notice is expected to include identification of the proposed new owner or operator, a description of its financial and technical capability to assume the obligations associated with the Project, and a statement of the new owner or operator's intention to take over the responsibilities in the XL Project of the existing owner or operator.

B. Within forty-five (45) days of receipt of the written notice, the Parties expect that EPA, the State of Maryland, and all applicable local agencies in consultation with all stakeholders, will determine whether: (1) the new owner or operator has demonstrated adequate capability to meet EPA's requirements for carrying out the XL Project; (2) is willing to take over the responsibilities in the XL Project of the existing owner or operator; and, (3) is otherwise an appropriate Project XL partner. Other relevant factors, including the new owner or operator's record of compliance with Federal, State and local environmental requirements, may be considered as well. It is expected that the implementation mechanism will provide that, so long as the demonstration has been made to the satisfaction and unreviewable discretion of EPA, the State of Maryland, and all applicable local agencies and upon consideration of other relevant factors, the FPA will be modified to allow the proposed transferee to assume the rights and obligations of the County. In the event that the transfer is disapproved by any agency, withdrawal or termination may be initiated, as provided in Section XI.

It will be necessary to modify the Agreement to reflect the new owner and it may also be necessary for EPA, the State of Maryland, and all applicable local agencies to amend appropriate rules, permits, or other implementing mechanisms (subject to applicable public notice and comment) to transfer the legal rights and obligations of the County under this Project to the proposed new owner or operator. The rights and obligations of this Project remain with the

County prior to their final, legal transfer to the proposed transferee.

X. Process for Resolving Disputes

Any dispute that arises under or with respect to this Agreement will be subject to informal negotiations between the Parties to the Agreement. The period of informal negotiations will not exceed twenty (20) calendar days from the time the dispute is first documented, unless that period is extended by a written agreement of the Parties to the dispute. The dispute will be considered documented when one party sends a written Notice of Dispute to the other Parties.

If the Parties cannot resolve a dispute through informal negotiations, the Parties may invoke non-binding mediation by describing the dispute with a proposal for resolution in a letter to the

Regional Administrator for EPA Region 3, with a copy to all Parties. The Regional Administrator will serve as the non-binding mediator and may request an informal mediation meeting to attempt to resolve the dispute. He or she will then issue a written opinion that will be non-binding and does not constitute a final EPA action. If this effort is not successful, the Parties still have the option to terminate or withdraw from the Agreement, as set forth in Section XI below.

XI. Withdrawal From or Termination of the Agreement

A. Expectations

Although this Agreement is not legally binding and any party may withdraw from the Agreement at any time, it is the desire of the Parties that it should remain in effect through the expected duration of the project, or until changes in generally applicable regulations make the requested flexibility unnecessary, or until the Subtitle D landfill portion of the Facility reaches capacity. The agreement will be implemented as fully as possible, unless one of the conditions below occurs:

1. Failure by any party to: (a) comply with the provisions of the enforceable implementing mechanisms for this Project, or (b) act in accordance with the provisions of this Agreement. The assessment of the failure will take its nature and duration into account.
2. Failure of any party to disclose material facts during development of the Agreement.
3. Failure of the Project to provide superior environmental performance consistent with the provisions of this Agreement.
4. Enactment or promulgation of any environmental, health or safety law or regulation after execution of the Agreement, which renders the Project legally, technically or economically impracticable.
5. Decision by an agency to reject the transfer of the Project to a new owner or operator of the facility.

The County will be given notice and a reasonable opportunity to remedy any substantial failure before EPA's withdrawal. If there is a disagreement between the Parties over whether a substantial failure exists, the Parties will use the dispute resolution mechanism identified in Section X of this Agreement. EPA, the State of Maryland, and all applicable local agencies retain their discretion to use existing enforcement authorities, including withdrawal or termination of this Project, as appropriate. The County retains any existing rights or abilities to defend itself against any enforcement actions, in accordance with applicable procedures.

B. Procedures

The Parties agree that the following procedures will be used to withdraw from or terminate the Project before expiration of the Project term. They also agree that the implementing mechanism(s) will provide for withdrawal or termination consistent with these procedures.

1. Any party that wants to terminate or withdraw from the Project is expected to provide written notice to the other Parties at least sixty (60) days before the withdrawal or termination.

2. If requested by any party during the sixty-(60) day period noted above, the dispute resolution proceedings described in this Agreement may be initiated to resolve any dispute relating to the intended withdrawal or termination. If, following any dispute resolution or informal discussion, a party still desires to withdraw or terminate, that party will provide written notice of final withdrawal or termination to the other Parties.

If any agency withdraws or terminates its participation in the Agreement, the remaining agencies will consult with the County to determine whether the Agreement should be continued in a modified form, consistent with applicable federal or State law, or whether it should be terminated.

3. The procedures described in this Section apply only to the decision to withdraw or terminate participation in this Agreement. Procedures to be used in modifying or rescinding any legal implementing mechanisms will be governed by the terms of those legal mechanisms and applicable law. It may be necessary to invoke the implementing mechanism's provisions that end authorization for the Project (called "sunset provisions") in the event of withdrawal or termination.

XII. Compliance After the Project is Over

The Parties intend that there be an orderly return to compliance upon completion, withdrawal from, or termination of the Project, as follows:

A. Orderly Return to Compliance with Otherwise Applicable Regulations Upon Expiration of the Project Term

The County is expected to anticipate and plan for all activities to return to compliance sufficiently in advance of the end of the Project term. The County will request a meeting with EPA, the State of Maryland, and all applicable local agencies to discuss the timing and nature of any actions that they will be required to take. The Parties agree to meet within thirty days of receipt of the County's written request for such a discussion. At and following such a meeting, the Parties should discuss in reasonable, good faith, which of the requirements deferred under this Project will

apply after termination of the Project.

B. Orderly Return to Compliance with Otherwise Applicable Regulations in the Event of Early Withdrawal or Termination

In the event of a withdrawal or termination not based on the end of the Project term and where the County has made efforts in good faith, the Parties to the Agreement will determine an interim compliance period to provide sufficient time for the County to return to compliance with any regulations deferred under the Project. The interim compliance period will extend from the date on which EPA, the State of Maryland, and all applicable local agencies provide written notice of final withdrawal or termination of the Project, in accordance with Section XI of this Project Agreement. By the end of the interim compliance period, the County will comply with the applicable deferred standards set forth in 40 CFR Part 258.28 and 40 CFR 258.60(f). During the interim compliance period, EPA, the State of Maryland, and any applicable local agency may issue an order, permit, or other legally enforceable mechanism establishing a schedule for the County to return to compliance with otherwise applicable regulations as soon as practicable. This schedule cannot extend beyond 6 months from the date of withdrawal or termination. The County intends to be in compliance with all applicable Federal, State, and local requirements as soon as is practicable, as will be set forth in the new schedule.

XIII. Signatories and Effective Date

Thomas Voltaggio
Deputy Regional Administrator, EPA, Region 3

Date

Jerome Klasmeier,
Chief Administrative Officer
Anne Arundel County

Date

Jane Nishida
Secretary
Maryland Department of the Environment

Date

TABLE 1
SUMMARY OF FIELD-SCALE LEACHATE RECIRCULATION AND BIOREACTOR PROJECTS

PROJECT LOCATION AND REFERENCES	TYPE OF PROJECT	DESCRIPTION OF LANDFILL AND PERMITTED RECIRCULATION PRACTICES
Yorkshire, England Searner-Carr Landfill [Robinson and Maris, 1985]	Field-Scale Study	6.2-acre cell used as leachate recycle area. Approximate 6-acre control area. Cell lined with 100-mil HDPE with leachate collection system. 13 ft of pulverized refuse placed in cells. Leachate redistributed by spray pipe networks laid on top of refuse. Furrows later dug into surface to reduce ponding. Recirculation and monitoring period approximately 3 years. 36,000 gallons of leachate storage available.
Delaware Solid Waste Authority Central Solid Waste Management Center Sandtown, Delaware [Vasuki, 1986]	Field-Scale Study	Leachate recycle in 2 full-scale landfill cells. 9-acre cell using recharge wells. 18-acre cell using four wells and traveling spray irrigation system. Total leachate storage capacity of 40,000 gallons. Cells lined with 30-mil PVC synthetic liner with leachate collection systems. Average refuse depth in cells is 30 ft.
Lycoming County Landfill Williamsport, PA [Natale and Anderson, 1986]	Full-Scale Operations with Study	Three 10-acre leachate recycle cells. 20-mil PVC used to line cells along with leachate collection systems. Various leachate recycle strategies attempted but not detailed. Authors observed recharge wells to work best. Eight years of data collection included flow measurement (collect and recycle); rainfall; landfill surface conditions (monthly); and quarterly leachate quality monitoring.
Southwest Landfill Alachua County, Florida [Reinhart, 1996] [Townsend et al., 1996]	Full-Scale Operations with Study	Composite lined area is 27 ac (10.9 ha). Waste was first accepted in Spring 1988. Receives 10,000 tons/month (9,070 Mg/month) of MSW. Maximum waste thickness will be 65 ft (20 m). Permitted to recirculate up to 60,000 gal/day (227 m³/day). Storage tank capacity is Storage tank capacity is Storage tank capacity is From 1990-1992, over ponds. In 1993, began using vertical spacing of 20 ft of leachate From March through September From March through September From March through September 2,950 2,950 2,950 m³/month /month) of /month) of /month) of leachate /month) of leachate /month) of leachate

PROJECT LOCATION AND REFERENCES	TYPE OF PROJECT	DESCRIPTION OF LANDFILL AND PERMITTED RECIRCULATION PRACTICES
Central Landfill Facility Worcester County, Maryland [Reinhart, 1996] [Kilmer, 1991]	Full-Scale Operations	Lined area consists of four 17-ac (6.9-ha) cells. Began operating in 1990. Maximum fill height will be 90 ft (27 m). Receives 200 tons/day (181 Mg/day) of MSW. Storage tank capacity is 400,000 gal (1,514 m ³). Leachate is recirculated using surface ponds or spraying, provided spraying is limited to a 2-week duration at any one location.
Winfield Landfill Columbia County, Florida [Reinhart, 1996]	Full-Scale Operations	Current lined area is 7 ac (2.8 ha), with plans to expand to 22 ac (8.9 ha). Began operating in 1992. Maximum fill height will be 54 ft (16.5 m). Receives 120 tons/day (109 Mg/day) of MSW. Aeration lagoon capacity is 50,000 gal (189 m ³). Permitted to recirculate using surface ponds or spraying, provided spraying is limited to a 2-week duration at any one location.
Pecan Row Landfill Loudes County, Georgia [Reinhart, 1996]	Full-Scale Operations	The ultimate lined area will be 40 ac (16 ha). Individual cells, 3.5 to 4 ac (1.5 to 1.6 ha) in area, are constructed approximately every 7 months. Maximum fill height will be approximately 60 ft (18 m). Receives 600 ton/day (544 Mg/day) of MSW. Lagoon capacity is 821,000 gal (3,100 m ³). Horizontal leachate injection trenches are constructed on top of each waste lift; the previous lift of trenches is abandoned when each new lift of trenches is constructed. Cover soil is removed prior to subsequent waste placement.
Lower Mount Washington Valley Secure Landfill Conway, New Hampshire [Reinhart, 1996]	Full-Scale Operations	Composed of eight hydraulically separated double-lined cells, each 0.75 to 1.0 ac (0.3 to 0.4 ha) in area. Receives 10,000 to 15,000 tons/yr (9,070 to 13,600 Mg/yr) of MSW Storage tank capacity is 10,000 gal (38 m ³). Filling began in January 1992, and was temporarily discontinued in November 1993. Leachate was recirculated primarily by pre-wetting using a fire hose and also using a pipe manifold placed in a shallow excavation in daily cover.
Coastal Regional Solid Waste Management Authority Landfill Craven County, North Carolina [Reinhart, 1996]	Full-Scale Operations	Consists of three hydraulically separated cells totaling 22 ac (8 ha) in area. Final waste height will be approximately 50 ft (15 m). Receives 350 tons/day (318 Mg/day) of MSW. Aeration lagoon capacity is 2.4 million gal (9,085 m ³). Leachate is injected using a movable vertical injection system consisting of 12 10-ft (3-m) long perforated black iron probes inserted into the landfill and connected to a manifold. The system stays in one location for 2 to 8 days. Leachate is injected at a pressure of 45 psi (310 kPa). At the completion of each of the four planned lifts, horizontal trenches will be constructed in a pattern radiating from a central distribution box. Each lift of trenches will be abandoned when the subsequent lift of trenches is constructed.

PROJECT LOCATION AND REFERENCES	TYPE OF PROJECT	DESCRIPTION OF LANDFILL AND PERMITTED RECIRCULATION PRACTICES
Lemons Landfills Stoddard County, Missouri [Reinhart, 1996]	Full-Scale Operations	Ultimate fill area will be 75 ac (30 ha). Maximum fill height will be 85 ft (26 m). Receives 300 tons/day (272 Mg/day) of MSW. Lagoon storage capacity is 867,800 gal (3,280 m ³). Leachate recirculation will be performed using vertical discharge wells located at 200-ft (61-m) intervals. Leachate will be managed using two lagoons: the first lagoon will collect leachate until recirculation reduces leachate strength significantly, at which time leachate will be diverted to the second lagoon and used to irrigate closed areas of the landfill.
Mill Seat Landfill Monroe County, New York [Reinhart, 1996]	Full-Scale Operations with Study	The bioreactor research project involves three hydraulically separated double composite lined cells varying from 5.4 to 7.4 ac (2.2 to 3 ha) in area. One cell serves as a control (i.e., no recirculation); two different horizontal leachate injection systems are used in the other two cells. Cell 2 has horseshoe-shaped injection trenches at three elevations, and a storage tank capacity of 20,000 gal (76 m ³). Cell 3 has horizontal trenches at two elevations containing pre-fabricated infiltrators, and a storage tank capacity of 20,000 gal (76 m ³). The relative moisture content of the waste will be monitored using gypsum blocks located in the waste.
Delaware Solid Waste Authority Southern Solid Waste Management Center Sussex County, Delaware [Maier and Vasuki, 1996]	Full-Scale Operations	Leachate was recirculated in Cells 1 and 2 using vertical injection wells from 1985 to 1994. For Cell 3, a horizontal integrated leachate recirculation and landfill gas extraction system is planned; lifts of separate injection and extraction trenches will be installed every 20 ft (3 m) vertically.
Charles City County Landfill Charles City County, Virginia [WM Solid Waste Permit No. 531]	Full-Scale Operations	Leachate is injected into horizontal trenches filled with shredded tires. The landfill is operated by USA Waste.
Pine Bluff Landfill Cherokee County, Georgia [Georgia Solid Waste Permit No. 028-039 D (SL)]	Full-Scale Operations	Leachate is injected into horizontal trenches. The landfill is operated by USA Waste.
Quail Hollow Landfill Tulahoma, Tennessee [Tennessee Solid Waste Permit No. SNL-02-102-0101]	Full-Scale Operations	Leachate is sprayed into the working face. The landfill is operated by USA Waste.
Cedar Ridge Landfill Louisberg, Tennessee [Tennessee Solid Waste Permit Number SNL-59-102-0238 EXT]	Full-Scale Operations	Leachate is sprayed into the working face. The landfill is operated by USA Waste.

PROJECT LOCATION AND REFERENCES	TYPE OF PROJECT	DESCRIPTION OF LANDFILL AND PERMITTED RECIRCULATION PRACTICES
Southern Sanitation Landfill Russelville, Kentucky [Kentucky Solid Waste Permit Number 071-00006]	Full-Scale Operations	Leachate is sprayed into the working face. The landfill is operated by USA Waste.

TABLE 2
SUMMARY OF BENEFITS FOR LANDFILL BIOREACTORS

Decreased Leachate Management Costs
Landfill Life Extension and/or Reduced/postponed need for new landfill space
Reduced Duration of Leachate Production
Reduced Duration of Landfill Gas Generation
Improved Leachate Quality in Long-Term
Decreased Long-Term Threat of Leachate to the Environment
More Complete Degradation of Waste During Period of Active Waste Disposal
Accelerated generation of Landfill Gas, facilitating more efficient control of Landfill Gas.

Table 3
Comparison of Baseline Project to a Full Scale Application of Bioreactor techniques

Superior Environmental Performance Criteria	Baseline Project (without bioreactor)	Proposed Bioreactor Project
Extension of Landfill Life	0 years	Approx. 5 years
Leachate Strength (Contamination Potential)	Medium to high over long term	Lower organics and metals over short term
Waste Stabilization	25-70 years	5-10 years
Landfill Settlement (net)	Unknown	20%+ increase expected

Leachate strength will be reduced under this Project, regardless of whether bioreactor techniques are eventually applied to other areas of the Facility.

Data obtained from Yolo County Project XL Proposal, dated 9/14/99.

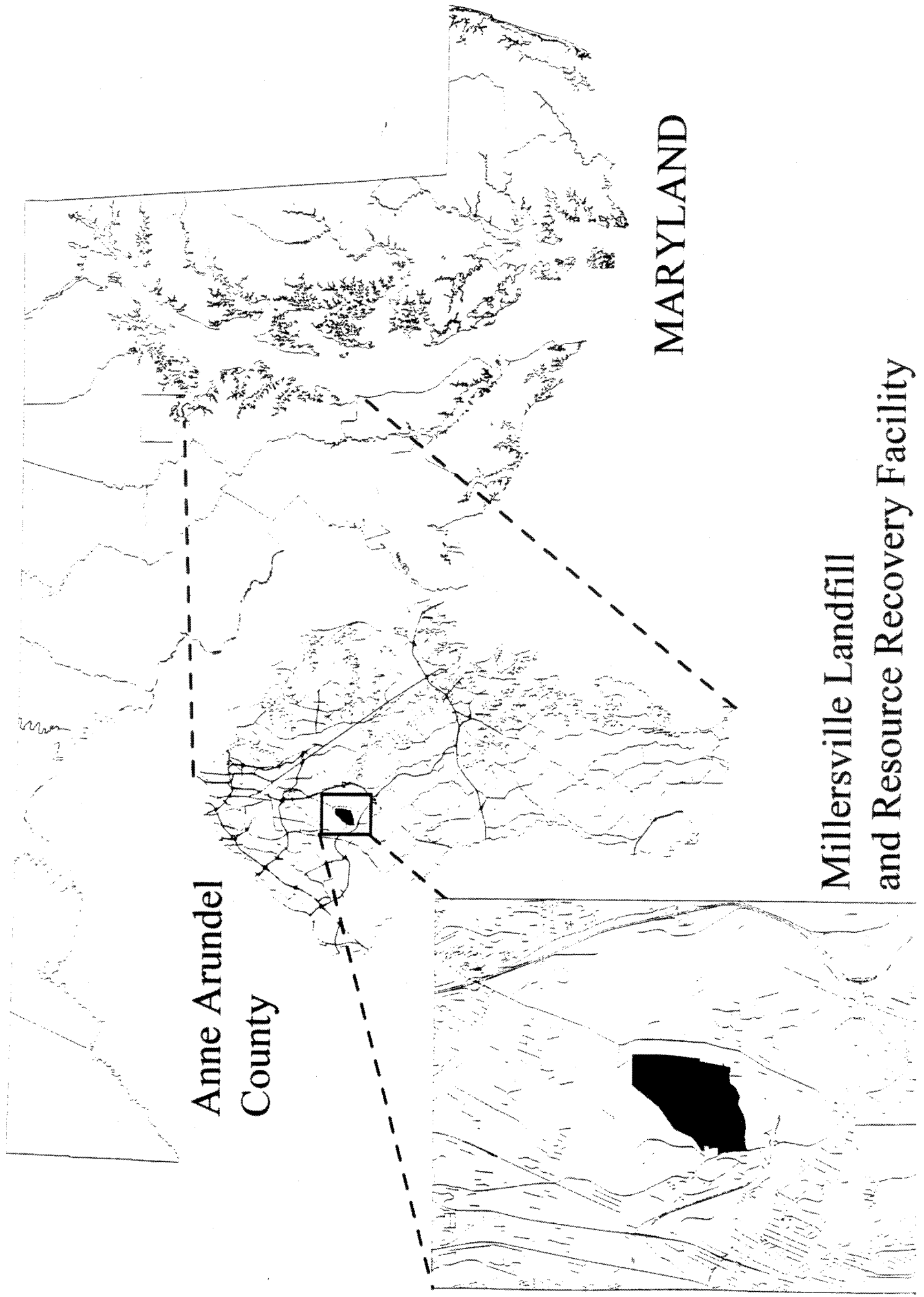
Table 4
Instrumentation Type and Location for the Anne Arundel Bioreactor Project

Type of Instrumentation	Location	Description
Gas Composition, Gas Pressure, and Flow (if supplemental LFG collection measures are required to be undertaken)	Connection[s] will be located at at a point prior to the common header.	Gas meter connection ports will allow connection of gas meter to collect data.
Leachate Flow Measurement	Outflow from each cell is measured at each sump. Inflow is measured at the injection manifold.	The volumes of liquids removed from Subcells 8-4 and 8-6 are monitored via time-of-operation meters wired to each Subcell s pumps. The quantity of leachate added to the bioreactor plumbing is measured at a flow meter at the head of the distribution system.

Monitoring Parameters and Frequency at the Anne Arundel Bioreactor Project

Rev. 12/07/00 (1:20pm)

Attachment I.
Vicinity Map and Capital Investment Map



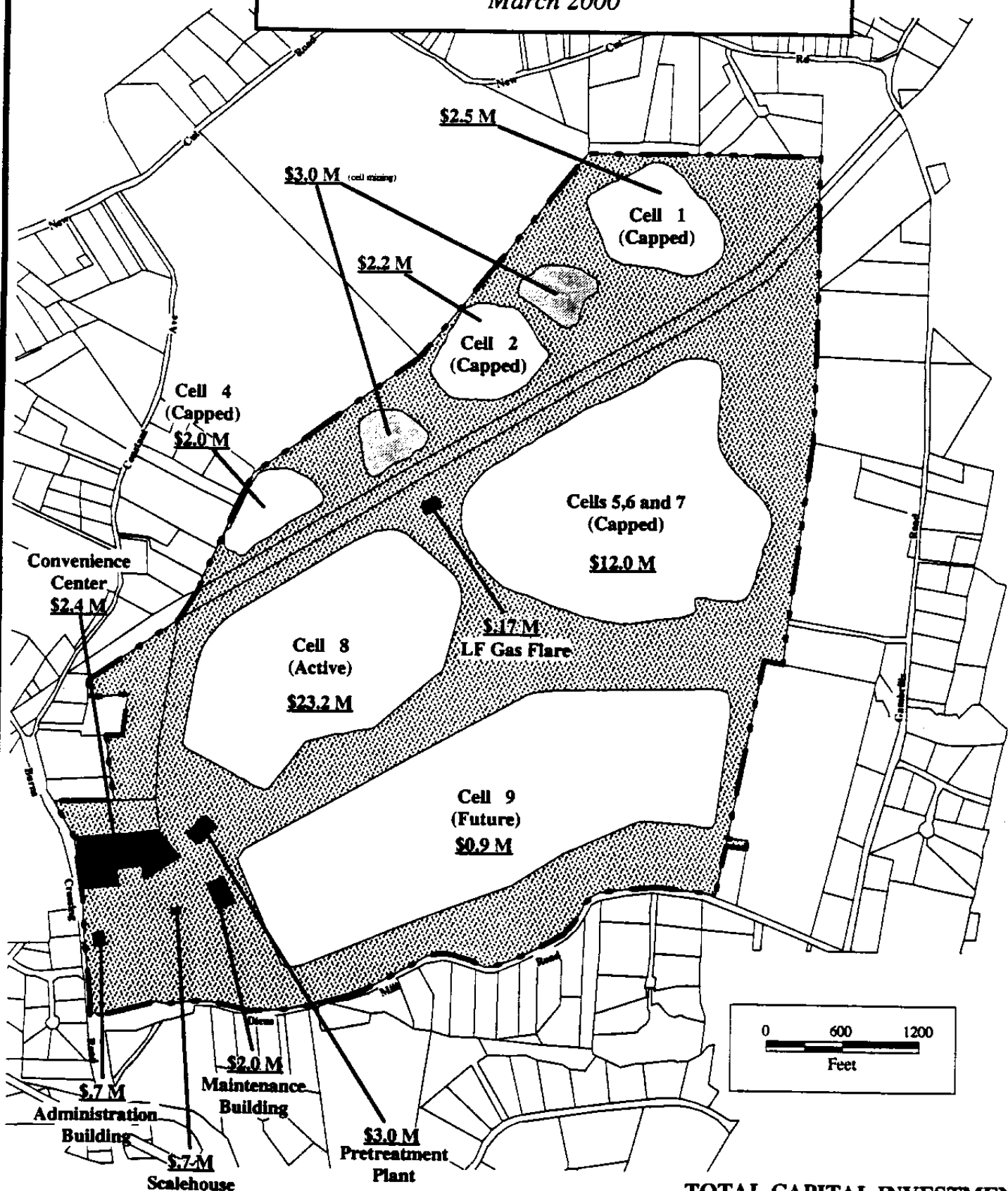
Anne Arundel
County

MARYLAND

Millersville Landfill
and Resource Recovery Facility

ANNE ARUNDEL COUNTY MILLERSVILLE LANDFILL AND RESOURCE RECOVERY FACILITY

March 2000



Note: Capping Includes LF Gas System Components

Attachment II.
USEPA and MD approval letters for Alternate Liner System



MARYLAND DEPARTMENT OF THE ENVIRONMENT
2500 Broening Highway • Baltimore, Maryland 21224
(410) 631-3000

William Donald Schaefer
Governor

David A.C. Carro
Secretary

March 1, 1994


Mr. Thomas Voltaggio, Regional Administrator
U.S. Environmental Protection Agency
Region III
841 Chestnut Building, 3HW00
Philadelphia PA 19107

Dear Mr. Voltaggio:

I request that, in accordance with 40 CFR Part 258.40(e), you review the enclosed materials documenting our evaluation of a proposed alternative liner design for Cell 8 of Millersville Sanitary Landfill in Anne Arundel County, Maryland. To facilitate your review, enclosed please find a brief summary of the site history, a copy of materials that we used to document our evaluation process and the technical information submitted to us by Anne Arundel County Department of Public Works which is the owner and operator of this landfill. Based on our extensive review of the enclosed technical information and modeling results, I hereby certify that the alternative liner design meets EPA's performance standard established in 40 CFR Part 258.40(a)(1).

Should you require further information concerning the petition, please contact Mr. Edward M. Dexter, Chief, Solid Waste Compliance Division, at (410) 631-3364. Thank you for your assistance.

Sincerely,


Richard W. Collins, Director
Waste Management Administration

RWC:lak

Enclosure



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107-4431

Barry S.

MAR 30 1994

RECEIVED

Honorable David A.C. Carroll, Secretary
Maryland Department of the Environment
2500 Broening Highway
Baltimore, Maryland 21224

APR 1 1994

WASTE MANAGEMENT
ADMINISTRATION

Dear Mr. Carroll:

In a letter dated March 1, 1994, the Maryland Department of the Environment submitted a petition to EPA, as allowed under 40 CFR 258.40(e), for our approval of an alternate liner system proposed for an expansion of the Millersville, Anne Arundel County municipal solid waste landfill. The letter contained extensive technical documentation supporting your position that the liner, which is an alternate to the composite liner system required by the EPA regulations, meets the EPA performance standards.

Our review has confirmed that the proposed liner system does meet the EPA performance standard, and I am therefore pleased to inform you that EPA hereby approves your determination for the alternate liner design for the expansion of the Millersville landfill.

Our review and approval is limited to only the acceptability of the liner system for this expansion under the 40 CFR 258.40(e) petition process, and does not imply approval of any other state or EPA requirements pertaining to this landfill.

Should you have any questions or concerns on this action, please contact Andrew Uricheck of the RCRA program, at 215-597-7936.

Sincerely,

Stanley L. Laskowski
Acting Regional Administrator

cc: Mr. Richard W. Collins, MDE (with attachment) ✓
Mr. Edward M. Dexter, MDE (with attachment)

Attachment III.
Resident Population around Landfill



Millersville Landfill and Resource Recovery Facility

389 Burns Crossing Rd.
Severn, MD 21144

Regional Population

Legend

Buffered Distance from Landfill
with Population Inside Buffer

- 0.25 Mile - 900 People
- 0.5 Mile - 2738 People
- 1 Mile - 5789 People



**ANNE
ARUNDEL
COUNTY**
M A R Y L A N D

DATE: March 7, 2000
FILE: g:\mapdata\wv\semtgt.by\MLF population buffers.wor
MAP PRODUCTION: Department of Planning
and Code Enforcement
GIS Section

Attachment IV.
County s proposed Request to Amend AOS

**ADDENDUM NO. 1
ALTERNATE OPERATING SCENARIO
FOR
LANDFILL GAS MANAGEMENT**

**ANNE ARUNDEL COUNTY, MARYLAND
MILLERSVILLE LANDFILL AND RESOURCE
RECOVERY FACILITY**

Prepared by:

**ANNE ARUNDEL DEPARTMENT OF PUBLIC WORKS
Waste Management Services
389 Burns Crossing Road
Severn, MD 21144-3411**

&

**SCS ENGINEERS
11260 Roger Bacon Drive
Reston, Virginia 20190
(703) 471-6150**

**October 17, 2000
File No. 0297054.03**

EXECUTIVE SUMMARY

The County has submitted a Project XL application (dated March 15, 2000) to the US Environmental Protection Agency to conduct a bioreactor pilot project in a small portion of Cell 8. The purpose of this submittal is to amend the previously approved Alternate Operating Scenario (AOS) for Landfill Gas (LFG) Management, dated May 14, 1998, to include additional LFG features relative to the bioreactor pilot project. Upon project completion, LFG management will resume in accordance with the May 1998 AOS.

The system will be designed to collect and control LFG in accordance with 40 CFR Part 60 Subpart WWW. The need to collect and control LFG will be evaluated as the project progresses, based on methane surface emission monitoring, and observations of odors. The County will undertake LFG collection and control if methane surface emissions exceed 500 ppm or significant odors from the test area are observed, as hereinafter provided.

Surface monitoring will be conducted on an area approximately 180' x 300' that includes the bioreactor test area (see Att. 1), and will be conducted in accordance with the Subpart WWW. Record keeping and reporting will also be conducted in accordance with Subpart WWW.

I. INTRODUCTION

I.A. BACKGROUND

The normal operating scenario for LFG management at the Millersville Landfill is described in documents previously submitted to the Maryland Department of the Environment (MDE), namely

- LFG Management System Design Plan, prepared by SCS Engineers, June 9, 1997; and
- Part 70 Operating Permit Application, July 1997.

Anne Arundel County also submitted the following report:

- Alternate Operating Scenario (AOS) for Landfill Gas (LFG) Management, prepared by GeoSyntec Consultants, May 14, 1998.

This report amended and updated the previously mentioned reports by presenting an alternate operating scenario for LFG management. The AOS provides for the collection of LFG from leachate collection system components, rather than from typical LFG extraction wells and/or trenches. (Note that the AOS is being implemented in the active cell only, i.e., Cell 8. All other Cells of the landfill are closed, capped, and operate under the normal operating scenario.)

Since submitting the May 1998 AOS document, the County has submitted a Project XL application (dated March 15, 2000) to the US EPA to conduct a bioreactor pilot project in a small (approximately ¼ acre) portion of Cell 8, and has negotiated a Final Project Agreement ("FPA") documenting the intentions of EPA, MDE, and the County with regard to the project. Assuming this FPA is approved, certain new LFG control features may have to be added to the LFG management system as provided herein.

I.B. PURPOSE

The sole purpose of this addendum is to incorporate the LFG management features of the proposed bioreactor pilot project into the AOS (provided the project is approved). Upon project completion (defined below), LFG management will be undertaken in accord with the provisions of the original May 1998 AOS.

II. BIOREACTOR PILOT PROJECT DESCRIPTION

II.A. BACKGROUND ON BIOREACTOR LANDFILLS

A bioreactor landfill is a sanitary landfill that uses enhanced microbiological processes to transform and stabilize the decomposable organic waste within 5 to 10 years of implementation (compared to 30 to 100 years for "dry" Subtitle D landfills). Engineered bioreactor landfills can provide a more controlled means by which society can reduce the environmental impacts of landfills on the surrounding local environment. The bioreactor technology is gaining popularity in North America and Europe, and has been demonstrated at various landfills, particularly in areas where landfill closure is costly and/or where landfill siting is difficult. Engineered bioreactor landfills provide accelerated waste biodegradation, a means for recovery of capacity (air space), a means to enhance landfill gas generation rates, and a means to minimize long-term liability, among others.

II.B. PROJECT COMPONENTS

The County's bioreactor pilot project will involve injecting a controlled amount of liquids through injection devices into a small portion of the landfill over a four- to seven-year period (depending on effectiveness), and monitoring the settlement that results.

The objectives of the project are as follows:

1. Design and construct a bioreactor test area in an active cell of the Landfill;
2. Perform liquid injection in a controlled manner using different injection methods;
3. Monitor surface settlement and injection rates over a period of time; and
4. Evaluate results and ultimately select the method that will most effectively increase the Landfill's waste capacity.

The following subsections provide information on the proposed pilot design, simultaneously addressing apparent concerns. Attachments I and II includes the drawings of the test area location, proposed system layout, and related details.

II.B.1. Test Area Location

The proposed test area measures 160 feet by 200 feet and is located within Subcell 8-4 (refer to Attachment I). The waste volume in this area is about 95,500 cubic yards (waste top elevation is approximately 218 feet above sea level ("ASL") and bottom elevation is between 135 and 140 feet ASL) and the waste depth is about 80 to 85 feet. The test area is a plateau with a 2 percent slope toward the landfill's western and northern side slopes. The test area is adjacent to an existing haul road, which makes it accessible to tank trucks for easier liquid injection. Anne Arundel County evaluated other areas of the Millersville Landfill, but this test area proved to have the best conditions for the bioreactor pilot project.

II.B.2. Liquid Injection

To improve the evaluation of different infiltration systems, the test area is planned to include two vertical injection wells and two horizontal injection trenches. These are the two most commonly used and effective injection devices. The trenches will be excavated so that they slope away from the landfill sideslopes at a 2 percent grade, to minimize excavation depths, promote gravity drainage, and eliminate possible (landfill) side-slope seepage. The wells and trenches have been spaced to minimize overlapping areas of influence. This spacing reduces uncertainties that may be introduced by overlapping influences. Similar to proven methods used in the groundwater industry, the information gathered from individual injection devices may be used to design a comprehensive system.

Design details of the proposed vertical wells and horizontal trenches are shown in Attachment II. These devices are designed to maximize the amount of liquid that can be injected; however, actual injection rates used by the County will be varied according to rate of infiltration and resulting settlement. The vertical wells consist of slotted or perforated 6-inch diameter pipe centered in a 3-foot diameter borehole and backfilled with stone. The well depths will be selected to penetrate between one-third and one-half the overall waste depth. The horizontal trenches will consist of 6-inch diameter perforated or slotted pipe centered in a 2 x 1.5-foot trench, backfilled with high permeability stone or gravel. Proprietary leachate pipe products that are relatively new to the waste industry may also be considered.

Each injection device will be fed by a 6,500 gallon tank truck through a centrally located single hose connection, and a flow meter will be installed to allow measurement of liquid flow to each injection device. Four control valves will be installed to allow independent flow regulation to each of the injection ports. A central feed location will be used to ease system operations and reduce truck traffic that may affect settlement rates. Finally, precipitation will be recorded via a rain gauge to allow for adjustments to the injection rate.

III. LANDFILL GAS CONSIDERATIONS

Recognizing that liquid addition is known to enhance LFG generation (and provided that the project is approved by EPA and MDE), prior to the introduction of liquids over Subcell 8-4 the County will ensure that certain additional LFG features as identified below (i.e., LFG control, monitoring, record keeping, and reporting) will be undertaken as part of the AOS and incorporated into the bioreactor pilot project. Upon project completion (defined below), LFG management will return to the procedures set forth in the May 1998 AOS.

The LFG control system is and will continue to be designed to collect and control LFG in accordance with 40 CFR Part 60 Subpart WWW. To support continued LFG collection and control, each horizontal leachate injection trench pipe will be constructed with a flanged connection at the end opposite from the injection point. This connection will allow the County to install (if necessary) either a passive or an active system to combust the collected LFG. The need to collect and control LFG will be evaluated as the project progresses, based on methane surface emission monitoring, and observations of odors (detailed below).

The potential for surface emissions is greatest just over the test area. Recognizing, however, that LFG generated from the test area could potentially migrate beyond the test area, the County will monitor surface emissions over the entire "plateau area," which includes the test area. This plateau area measures approximately 180 feet by 300 feet and is essentially centered on the test area and borders the landfill sideslope (see Attachment II). Note that the landfill sideslope is covered with a clayey intermediate cap (hydraulic conductivity of about 10^{-4} to 10^{-5} cm/s), reducing the potential for sideslope surface emissions. Note also that the integrity of the sideslope cap is maintained with vegetative growth.

Prior to the introduction of liquids under this Project, the County will obtain a baseline surface methane concentration level throughout the plateau area to establish the baseline performance of the current gas collection and control system located in the plateau area, and will conduct subsequent surface emissions monitoring in accordance with the requirements in 40 CFR Part 60 Subpart WWW (see Table 1). If any quarterly surface monitoring shows a surface methane concentration that exceeds 500 ppm in the plateau area, or if significant odors are found to be emanating from the test area, the County will take additional corrective actions (which may include installation and operation of additional LFG collection and control technology) as provided in 40 CFR § 60.755.

Fires in landfills are usually caused by poorly designed or operated active LFG collection systems that introduce air or oxygen into the waste. If active collection is used for this project, it will be designed and operated to minimize the potential of fires, in accordance with Subpart WWW. The potential for landfill fires is also minimized on this project since it is based on the anaerobic bioreactor concept. Note that landfill fires are of much greater concern in aerobic bioreactor landfills that are designed to introduce air or oxygen into the waste.

Project Completion

At any time between four and seven years after the commencement of liquids addition under this Project, the County may choose to stop the Project and continue its landfilling operations in Subcell 8-4. If liquids addition is ceased between three and six years after the commencement of liquids addition, the bioreactor-related LFG features contained in this Addendum will be continued for one additional year after such cessation. If liquids addition is ceased between six and seven years after the commencement of liquids addition, the bioreactor-related LFG features contained in this Addendum will be continued at least through the seventh year after such commencement. Upon the cessation of the bioreactor-related LFG features contained in this Addendum, the project will be deemed complete and LFG management will be conducted in accordance with the original May 1998 AOS.

Table 1. LFG Monitoring Parameters and Frequency for the Bioreactor Project

Monitoring Parameter	Frequency	Description
CH ₄ , CO ₂ , O ₂ , balance gas (mainly N ₂), pressure, and temperature at each extraction point and at the main collection header pipe	Weekly	Utilize a GEM 500 infrared gas meter, or equal
Methane surface emissions	Quarterly (first sampling event to be conducted prior to first injection of liquids)	Conduct in accordance with Subpart WWW throughout the "plateau area" which includes the test area.
Non-methane organic hydrocarbons (NMOC) at the main collection header pipe	Semi-annually	Analysis in accordance with Subpart WWW
Gas flow rate	Continuous upon implementation of supplemental LFG control measures (if required).	Connection[s] will be located at a point prior to the common header.

IV. SCHEDULE

The duration of the pilot project is expected to be four to seven years, depending on effectiveness. The project schedule follows:

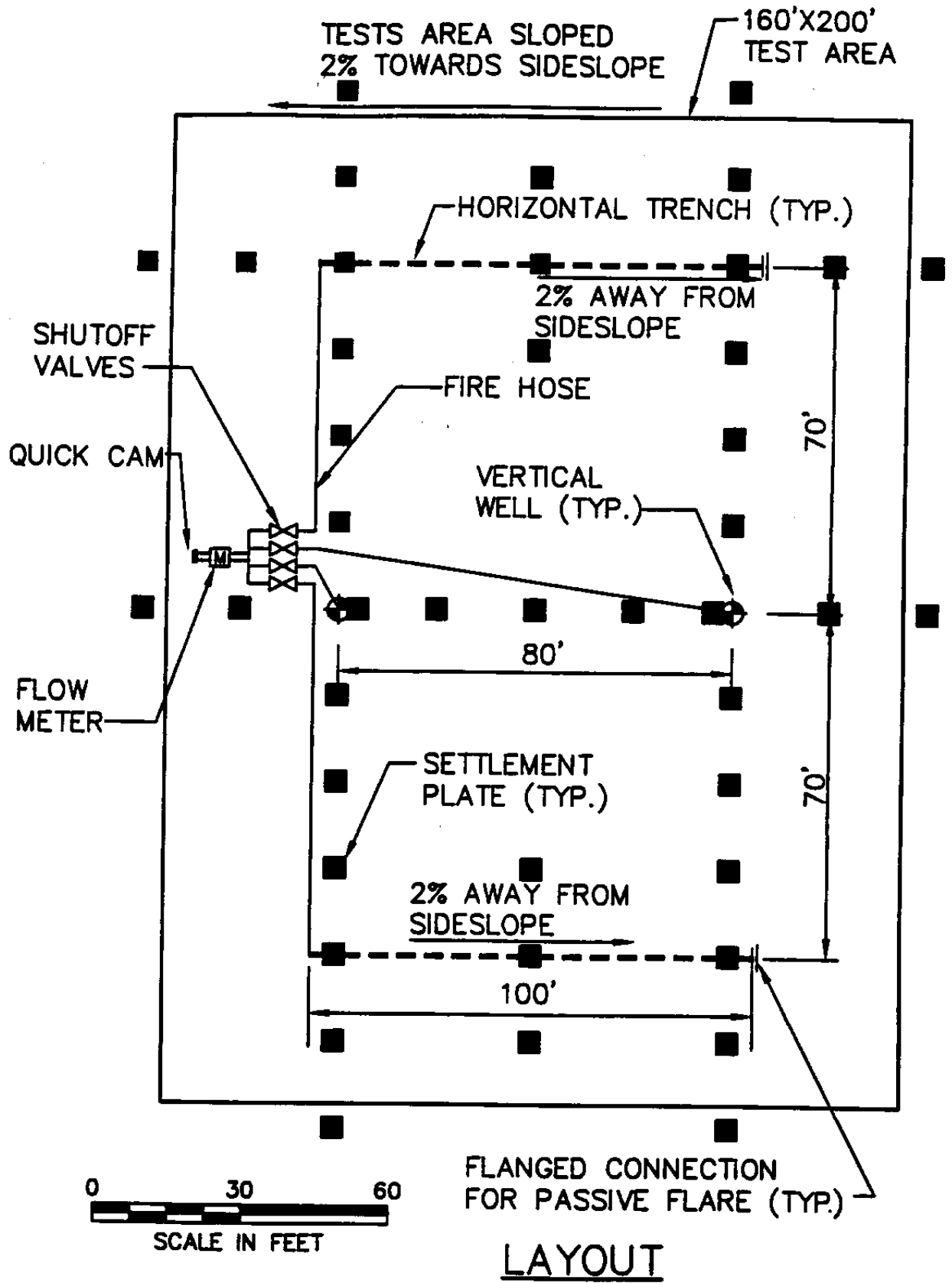
Obtain EPA and MDE approval.

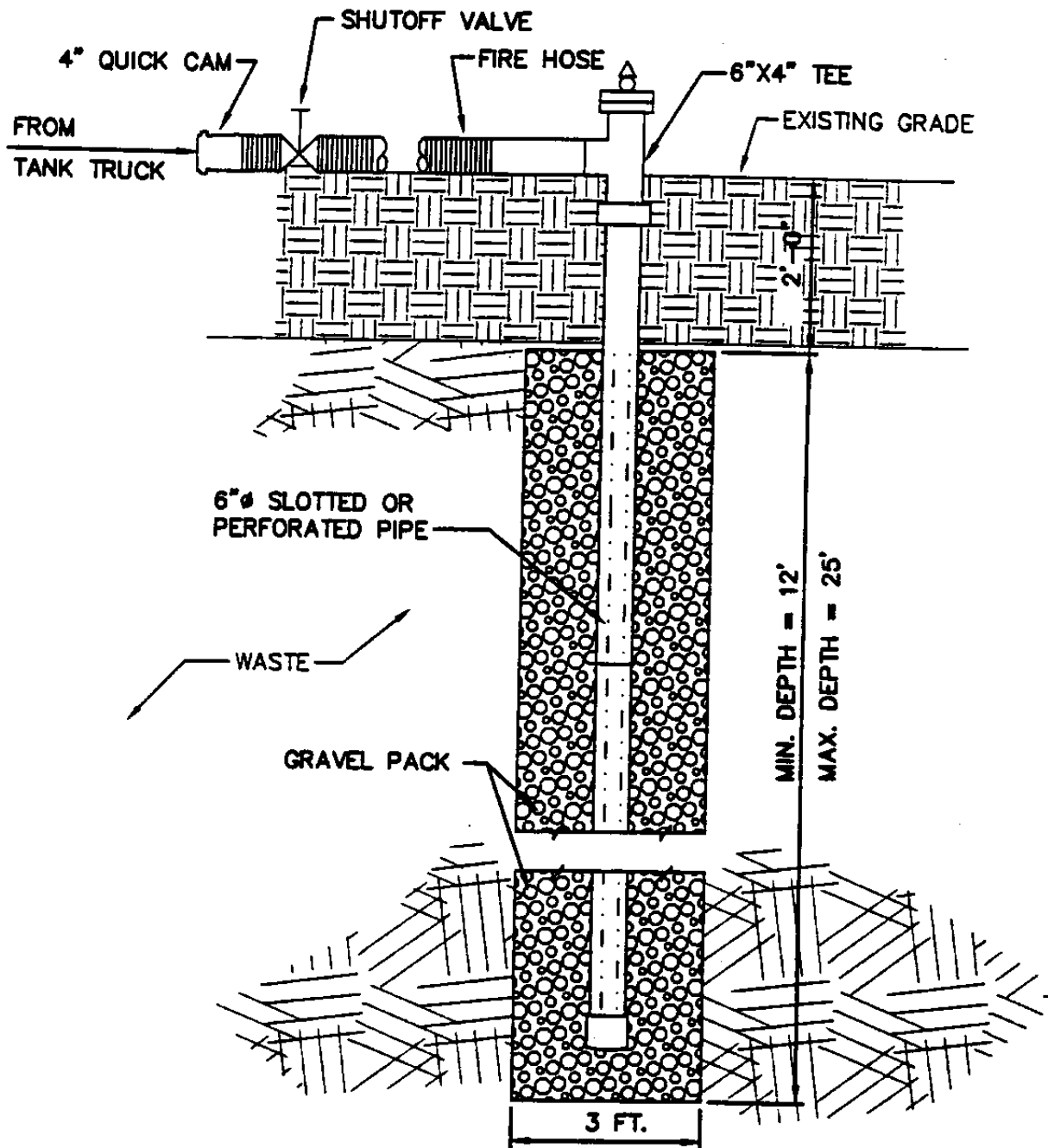
Construct pilot test facilities. Three months are estimated for this construction phase.

Perform controlled liquid injection while monitoring surface settlement, recirculation rates, and LFG parameters identified in Table 1 over the project's duration. During this period, the need collect and control additional LFG will be evaluated based on methane surface emission monitoring and observations of significant odors. Collection and control will occur if methane surface emissions exceed 500 ppm or significant odors from the test area are observed. Exceedances will be handled in accordance with the protocol outlined in Subpart WWW.

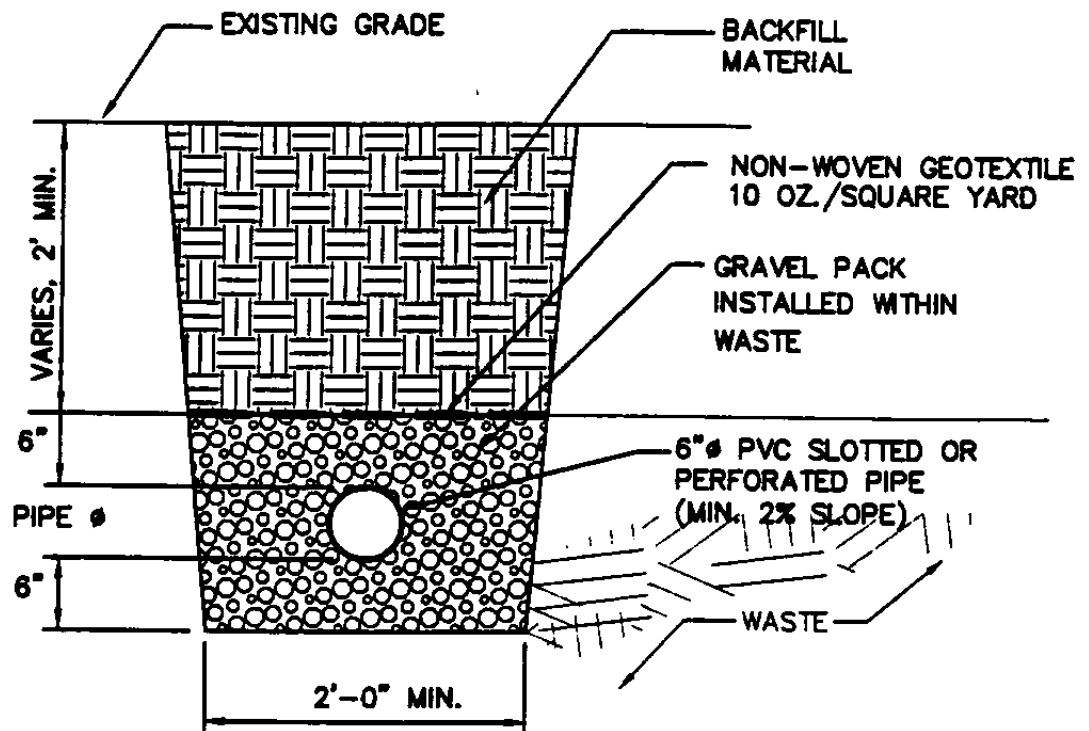
Attachment V.
System Layout and Details

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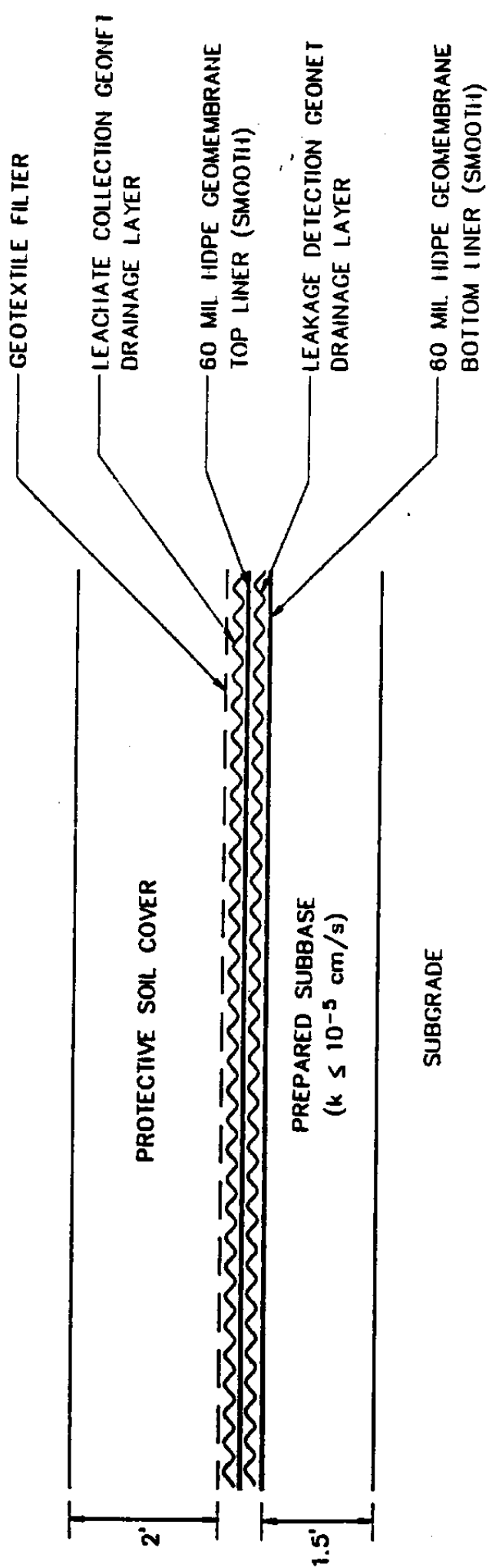


VERTICAL INJECTION WELL DETAIL
NO SCALE



HORIZONTAL INJECTION DEVICE DETAIL
NO SCALE

Attachment VI.
Liner Details



40
8

DETAIL

BASE LINER SYSTEM

SCALE: NTS

Attachment VII.
Leachate Analytical Results



1250 East King Street • Lancaster, PA 17602-3236 • phone: (717) 295-9145 • fax: (717) 295-1742 • GCIenvirsvc@redrose.net

November 18, 1999

Mr. Ray Riggin
Anne Arundel County
Department of Public Works
Bureau of Waste Management Services
Severn, Maryland 21144

**RE: Data Report for Leachate Samples Collected from Subcells
September - October 1999 at Millersville Landfill**

Dear Mr. Riggin:

GCI is pleased to provide you with two copies of the referenced report. The scope of work for this sampling event included the collection of six leachate samples from six discrete subcells at the referenced site. GCI personnel collected these samples, with assistance from AAC personnel, on September 30 and October 1, 1999. These samples were tested for volatile organic compounds (VOCs), total metals and general chemistry parameters. The attached Tables 1 and 2 show the analytical results for the six samples.

Maryland Spectral Services and Atlantic Coast Laboratories provided analytical services in support of this project. The analytical data reports prepared by the analytical laboratories are attached to this letter report.

If you have any questions concerning the information in this report please do not hesitate to give me a call at your earliest convenience.

Sincerely,

Steven A. Brown

Department of Public Works
Waste Management Services
OPERATING RECORD

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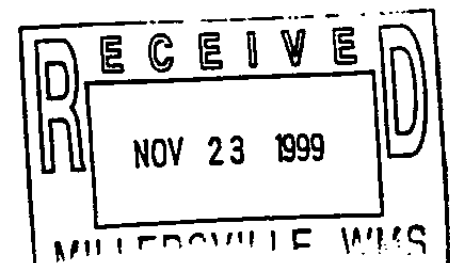


TABLE 1

POSITIVE VOLATILE ORGANIC COMPOUND RESULTS (ppb)
 FOR LEACHATE SAMPLES COLLECTED MARCH 1998 - OCTOBER 1999
 Millersville Landfill, Anne Arundel County, Maryland

Sample Designations	SUBCELL 8.1				SUBCELL 8.2				SUBCELL 8.3			
Sample Dates	3/98	6/98	10/98	10/99	3/98	6/98	10/98	10/99	3/98	6/98	10/98	10/99
Acetone	3,380	379	49	41	1,480	15	188	16	53	92	16	11
Benzene	ND	ND	ND	2.2 J	ND	4.5 J	ND	8.6	3.5 J	ND	ND	4.2 J
2-Butanone	8,850	618	ND	36	3,210	ND	254	ND	51	ND	ND	ND
Carbon disulfide	ND	ND	ND	ND	ND	2.5 J	ND	4.1 J	ND	8.8 J	ND	10
Chloroethane	43 J	22 J	17	16	48 J	20	10	14	5.1	12 J	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	4.9 J	3.8 J	ND	ND	6.3
1,1-Dichloroethane	28 J	ND	ND	ND	ND	11	ND	5.7	2.6 J	ND	ND	ND
Dichlorofluoromethane	ND	ND	ND	ND	ND	4.4 J	ND	2.3 J	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	4.5 J	ND	6.8	24	15	23	13 J	24	29
4-Methyl-2-Pentanone	ND	ND	ND	ND	274	63	ND	ND	ND	ND	ND	ND
Methylene chloride	167	ND	ND	2.0 J	ND	6.4	ND	ND	ND	ND	ND	ND
Toluene	1,130	275	21	4.6 J	300	80	150	7.2	4.3 J	25	ND	10
Vinyl chloride	ND	ND	ND	ND	ND	2.4 J	ND	ND	2.9 J	ND	ND	ND
o-Xylene	ND	ND	ND	3.9 J	ND	5.4	15	20	15	18 J	17	24
m+p-Xylene	ND	ND	5.4	7.8	32 J	12	37	49	32	44	39	54

Notes: 1) ND = None detected; 2) J = Estimated value between reporting and detection limit.

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TABLE 1, cont'd

POSITIVE VOLATILE ORGANIC COMPOUND RESULTS (ppb)
FOR LABCHATE SAMPLES COLLECTED MARCH 1998 + OCTOBER 1999

Millersville Landfill, Anne Arundel County, Maryland

Sample Designations	SUBCELL 8.4				SUBCELL 8.5				SUBCELL 8.6			
	3/98	6/98	10/98	10/99	3/98	6/98	10/98	10/99	3/98	6/98	10/98	10/99
Acetone	4,480	8,320	7,710	57	2,790	50	22	209	5,990	2,760	950	137
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	9,350	14,500	14,200	38 J	7,450	532	ND	454	24,200	7,050	4,770	340
Carbon disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	116	ND	ND	13 J	ND	48	30	ND	63 J	ND	ND	5.5 J
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	166	ND	ND	ND
Dichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	90 J	ND	ND	ND
Ethylbenzene	37 J	ND	ND	23 J	ND	28	27	23 J	ND	ND	ND	11
4-Methyl-2-Pentanone	ND	ND	ND	76	ND	60	ND	ND	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND	ND	ND	ND	14 J	782	ND	ND	ND
Toluene	1,750	2,630	1,070	705	4,230	792	14	1,170	476	ND	770	288
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	ND	ND	ND	25 J	ND	16 J	15	13 J	ND	ND	ND	6.0 J
m+p-Xylene	63	ND	ND	56	54 J	45	39	37	81 J	ND	ND	17

Notes: 1) ND = None detected; 2) J = Estimated value between reporting and detection limit.

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TABLE 2

TOTAL METALS AND GENERAL CHEMISTRY PARAMETER RESULTS (ppm)
 FOR LEACHATE SAMPLES COLLECTED MARCH 1998 - OCTOBER 1999
 Millersville Landfill, Anne Arundel County, Maryland

Sample Designations	SUBCELL 8.1						SUBCELL 8.2						SUBCELL 8.3					
	3/98	6/98	10/98	10/99	3/98	6/98	10/98	10/99	3/98	6/98	10/98	10/99	3/98	6/98	10/98	10/99	3/98	6/98
Arsenic	0.014	0.03	ND	ND	0.041	0.055	ND	ND	0.065	0.083	0.057	0.065	0.065	0.083	0.057	0.065	0.065	0.083
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.004	ND	ND	ND	0.004	ND	ND	ND	ND
Chromium	0.02	0.032	0.031	0.076	0.027	0.034	0.042	0.020	0.072	0.052	0.056	0.046	0.072	0.052	0.056	0.046	0.072	0.052
Copper	ND	ND	ND	0.034	ND	ND	0.019	ND	0.005	0.032	0.048	ND	0.005	0.032	0.048	ND	0.005	0.032
Iron	388	98.7	56.2	54.3	173	77.7	67.1	70.3	17.2	9.88	20.0	7.63	17.2	9.88	20.0	7.63	17.2	9.88
Lead	ND	ND	ND	0.053	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.058	0.060	0.092	0.124	0.032	0.025	0.039	0.025	0.136	0.108	0.104	0.081	0.136	0.108	0.104	0.081	0.136	0.108
Silver	0.02	0.02	ND	ND	0.01	0.01	ND	ND	0.01	0.02	ND	ND	0.01	0.02	ND	ND	0.01	0.02
Zinc	0.036	0.062	0.039	0.527	0.004	0.003	ND	0.013	0.03	0.015	ND	0.013	0.03	0.015	ND	0.013	0.03	0.015
BOD	>2,170	256	97	61	545	66	67	9	75	77	168	47	75	77	168	47	75	77
Nitrate	ND	ND	0.162	ND	0.24	ND	0.186	ND	ND	ND	0.235	ND	ND	ND	0.235	ND	ND	ND
Nitrite	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total alkalinity	2,300	3,040	3,700	4,000	1,700	2,370	3,700	1,800	5,600	4,770	5,500	5,200	5,600	4,770	5,500	5,200	5,600	4,770
Orthophosphate	0.02	0.36	ND	0.02	0.01	0.66	0.03	0.15	1.4	1.5	0.11	0.46	1.4	1.5	0.11	0.46	1.4	1.5
Total suspended solids	302	244	228	1,950	326	184	138	272	39	31	126	22	39	31	126	22	39	31
Ammonia	280	430	410	510	200	280	340	260	990	800	900	870	990	800	900	870	990	800
COD	4,400	800	490	674	1,000	420	430	250	1,000	860	880	819	1,000	860	880	819	1,000	860
Total kjeldahl nitrogen	320	450	490	590	240	350	390	290	980	870	1,000	920	980	870	1,000	920	980	870
Cyanide	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloride	NA	614	350	789	NA	365	300	323	NA	1,070	475	1,150	NA	1,070	475	1,150	NA	1,070
pH, SU	NA	7.19	7.00	6.85	NA	6.90	7.10	6.69	NA	7.26	7.32	7.34	NA	7.26	7.32	7.34	NA	7.26
Specific conductivity, mS	NA	7.08	6.76	8.24	NA	5.07	5.62	4.38	NA	11.42	11.72	11.76	NA	11.42	11.72	11.76	NA	11.42
Total dissolved solids	NA	2,870	3,470	3,700	NA	1,900	2,370	1,500	NA	4,360	5,070	4,380	NA	4,360	5,070	4,380	NA	4,360

Notes: 1) ND = None detected 2) NA = Not analyzed

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TABLE 2, cont'd

TOTAL METALS AND GENERAL CHEMISTRY PARAMETER RESULTS (ppm)
FOR LEACHATE SAMPLES COLLECTED MARCH 1998 - OCTOBER 1999

Millersville Landfill, Anne Arundel County, Maryland

Sample Designations	SUBCELL 8.4				SUBCELL 8.5				SUBCELL 8.6			
	3/98	6/98	10/98	10/99	3/98	6/98	10/98	10/99	3/98	6/98	10/98	10/99
Arsenic	0.029	0.047	0.077	0.058	0.007	0.009	ND	ND	0.009	0.020	ND	ND
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.027	0.079	0.060	0.026	0.024	0.022	0.020	ND	0.02	ND	ND	ND
Copper	ND	ND	ND	0.013	ND	ND	ND	ND	ND	ND	ND	ND
Iron	454	490	260	48.1	203	21.6	25.9	76.1	476	490	180	72.0
Lead	0.059	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.028	0.059	0.083	0.078	0.051	0.074	0.088	0.017	0.024	ND	0.013	0.029
Silver	0.02	0.02	ND	ND	0.01	0.01	ND	ND	0.02	0.01	ND	ND
Zinc	0.142	0.065	ND	0.022	0.025	ND	ND	0.022	0.038	ND	ND	0.028
BOD	>2,110	6,200	3,950	204	2,140	71	58	233	>4,220	1,960	2,360	ND
Nitrate	1.00	ND	ND	0.22	ND	ND	0.116	ND	ND	ND	0.145	ND
Nitrite	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total alkalinity	2,000	3,110	2,900	3,000	1,400	3,250	3,700	940	1,500	1,240	2,200	1,920
Orthophosphate	0.04	0.15	0.04	0.01	ND	ND	0.17	ND	0.31	ND	ND	0.01
Total suspended solids	240	382	340	248	348	35	38	154	165	211	155	135
Ammonia	160	290	370	360	220	420	420	140	92	49	63	12
COD	4,500	10,000	4,700	690	3,800	490	450	318	7,300	3,600	770	216
Total kjeldahl nitrogen	210	420	420	420	250	520	500	150	170	130	70	21
Cyanide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloride	NA	438	350	637	NA	738	400	140	NA	155	200	51.4
pH, SU	NA	6.43	6.87	6.95	NA	7.08	7.08	6.47	NA	6.11	6.63	6.46
Specific conductivity, mS	NA	7.43	7.38	6.55	NA	7.41	7.35	2.01	NA	3.50	2.10	1.09
Total dissolved solids	NA	5,720	5,000	2,910	NA	3,190	3,370	881	NA	2,180	1,010	264

Notes: 1) ND = None detected

2) NA = Not analyzed

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Attachment VIII.
9/21/00 SCS analysis of LFG generation in area of bioreactor project

SCS ENGINEERS

September 21, 2000
File No. 02197054.03

Ms. Michele Laur
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Standards Division
Mail Drop - 13
Research Triangle Park, NC 27711

Subject: Project XL Final Project Agreement- Bioreactor Pilot Project
Anne Arundel County, Maryland

Dear Ms. Laur:

As requested in our September 15, 2000 teleconference, this letter provides supplemental information regarding the statement in the Final Project Agreement (FPA), Landfill Gas Consideration section, that there is a reduced potential for landfill gas (LFG) emissions at the landfill sideslope.

SCS feels that the statement is valid based on the following factors (refer to the attached drawing that shows the location of the surface monitoring area):

1. The landfill sideslope is covered with an intermediate cap that consists of a vegetative layer over a 2-foot soil layer. The permeability of the soil layer ranges from 10^{-4} to 10^{-5} cm/sec, which indicates that the soil is fairly impervious. Based on our engineering experience with LFG migration, collection and control, this intermediate cap should create a fairly good barrier to LFG penetration, confining LFG inside the waste, and increasing the potential for LFG to migrate to collection devices. Note also that the County maintains vegetative growth on the sideslope cap, upholding its integrity.
2. The existing LFG collection system for Cell 8 is designed to apply a continuous vacuum to the leachate collection pipe network under the waste. This induces a pressure gradient inside the waste that tends to draw LFG toward the collection network. Collected LFG is piped to an enclosed flare for destruction.
3. As mentioned in the FPA, the County primarily used removable tarpaulins (tarps) as daily cover. This serves the project well, as it reduces barriers caused by daily soil cover and allows LFG to be influenced more effectively by collection devices.
4. As mentioned in the FPA, additional LFG collection and control may be implemented in the test area, based on results of methane surface emissions monitoring and observations of odors. Collecting additional LFG should reduce the potential for sideslope emissions and odors.



Ms. Michele Laur
September 21, 2000
Page 2

We hope that this supplemental information sufficiently justifies the statement. Should you have any questions, please call either of the undersigned.

Sincerely,



Darrin D. Dillah, Ph.D., P.E.
Project Manager
SCS ENGINEERS



W. Gregory Vogt
Vice President
SCS ENGINEERS

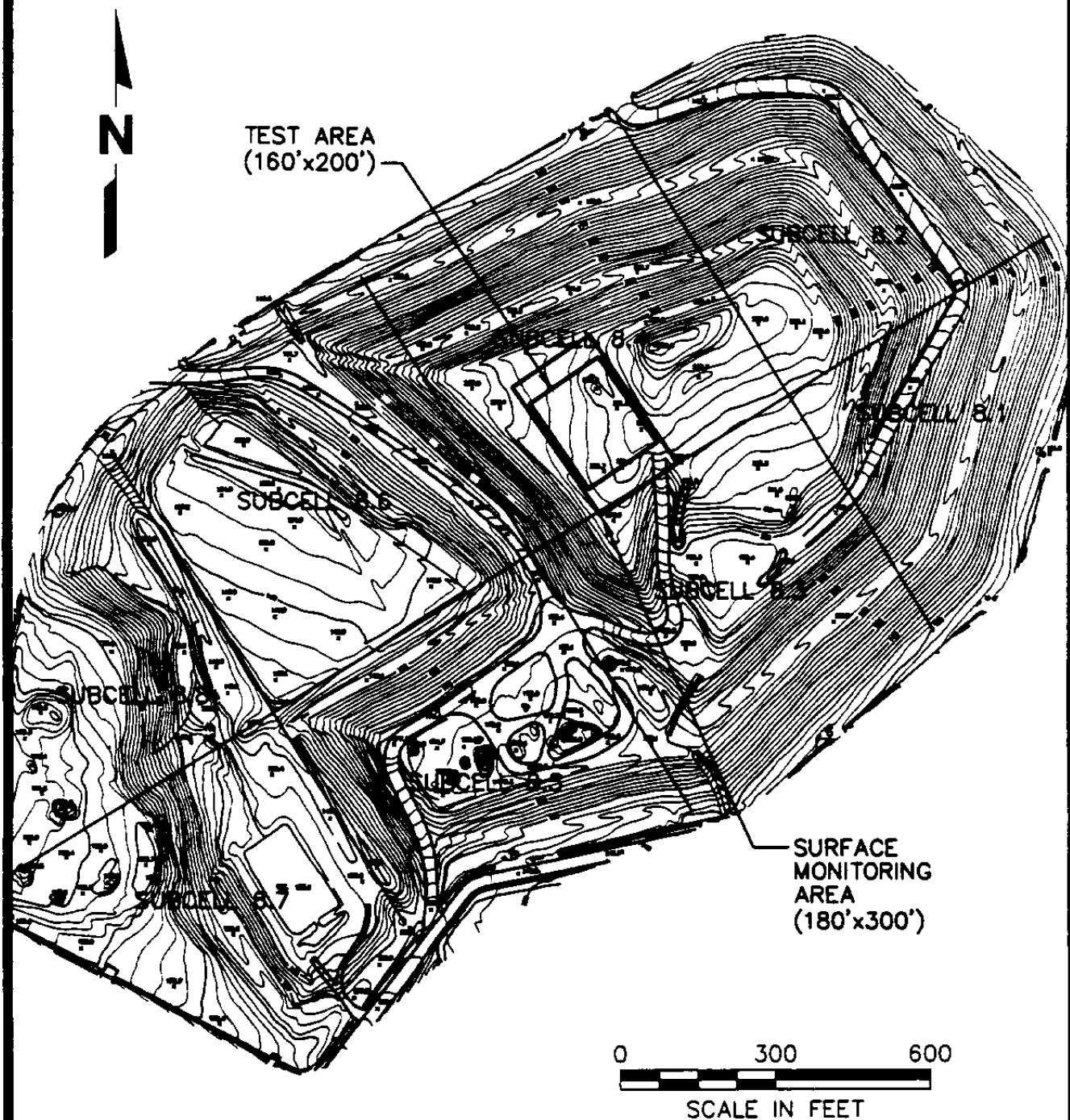
Attachment

cc: Robert Demarco, Anne Arundel County
Sherri L. Walker, USEPA, Office of Reinvention
Charles B. Howland, USEPA Region III, Office of Regional Counsel
Eric R. Peterson, SCS Engineers

ATTACHMENT

Surface Emissions Monitoring Area

DRAWN BY: RJS DATE: 9-20-00 FILE NAME: 02197054.03/SITE14



**BIOREACTOR PILOT PROJECT
SURFACE MONITORING AREA
MILLERSVILLE LANDFILL - CELL 8**

SCS ENGINEERS